MONTANA OUTDOORS

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MONTANA OUTDOORS

March/April 1989
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Revisiting the Smith

by Joel Shouse

The department's new management plan will meet the needs of today's recreationists while protecting the river's resources for future generations to enjoy.

Montana's Smith River originates in the Castle and Little Belt Mountains of west central Montana. Northwest of the community of White Sulphur Springs it flows through a deep limestone canyon in a near-wilderness setting abounding with wildlife. The 61-mile canyon section of the river between Camp Baker and Eden Bridge is the recreational heart of the river and is one of Montana's finest floating and fishing waters, attracting visitors from all over Montana and across the nation. Because of its reputation as an excellent trout stream and its outstanding scenic attributes, the river has become extremely popular in recent years.

As a result, numerous efforts have been made to give the Smith special recognition and to preserve and protect it. In 1972, the Fish and Game Commission designated the portion most popular for floating as the Smith River Recreational Waterway, and prohibited use of motorboats on the entire river. Since 1981, the Department of Fish, Wildlife and Parks (DFWP) has attempted to reduce the impacts on private landowners along the river by hiring a seasonal river ranger to patrol the most heavily floated section. In 1984, an Ad Hoc Advisory Committee was established to work with and advise the DFWP on the river's management. This committee is made up of recreationists, outfitters, landowners, U.S. Forest Service (USFS) personnel, and DFWP employees.

The river ranger program and the work of the ad hoc committee have provided the foundation for the department's Smith River management program. In 1985, I was retained by the department to undertake additional studies and to make recommendations for a formal management plan. The plan's development included input from DFWP and USFS personnel, the ad hoc committee, and the public. The draft plan was circulated for public review and presented at public meetings in early 1988, and the final version was endorsed by the Fish and Game Commission last summer.

The goals of the plan are to identify ways of providing continued recreational use and enjoyment of the river, consistent with the river's capacity to sustain this use; to seek ways of minimizing conflicts between river users and landowners; and to protect the integrity of the river's water and canyon resources for future generations to enjoy. The plan deals only with the stretch of river between Camp Baker and Eden Bridge. This section has no public access between the put-in and take-out points and only limited private access due to the near-vertical walls of the canyon. Recreational use here is typically in the form of three- to five-day float trips with overnight camping along the river.

PUBLIC USE MANAGEMENT

The pattern of land ownership significantly affects public use of the floating section; more than 80% of the river frontage is in private ownership, while the remainder is under state and federal jurisdiction. Most of the private ownership is in large ranches, but there are some small recreational lots along the river with summer cabins. At present, there are only a handful of year-round residences between Camp Baker and Eden Bridge, and only one of these is in the canyon.

Studies to date have shown that floating traffic on the Smith River during times of peak use exceeds the capacity of the available campsites. At such times, the quality of the experience may be lost for some floaters. Recreational use is projected to increase in the future, which further underscores the need for careful management.

The present use capacity of the river has been designated as 100 floaters launching per day, based primarily on the capability of existing campsites to house floaters overnight. The DFWP is conducting studies to further refine river capacity based both on physical and social criteria. Elements that will be considered include floater opinion, landowner attitudes, and an overall assessment of physical impacts on the river environment. The DFWP intends to reassess the river's "carrying capacity"—its ability to absorb recreational use—at least every three years.

Present use of the river has been measured and evaluated in terms of the number of floaters per day. However, there are some benefits in measuring use in terms of the number of floating parties per day. Should a permit system ultimately be implemented for regulating river use, the DFWP will probably change from limiting the number of floaters to limiting the number of parties per day. At present, 100 floaters per day converts to about 15 float parties per day. In the future, the maximum size of float parties would likely be set at 15 people based on the present capacity of boat camps.

Because not all recreationists have the specialized equipment and skills necessary to take a float of several days' duration the DFWP and USFS have determined that it is desirable to have some commercial outfitting on the Smith. The USFS presently has a policy that requires outfitters who use public lands under its jurisdiction to obtain permits and pay fees. Because the

Smith River photo: Dave Books

Lewis and Clark National Forest adjoins the river on the east side for approximately 30% of the float section and a significant number of boat camps are on these lands, the USFS has decided to issue outfitter permits for its land on the Smith beginning in 1989. To conform with the procedure outlined in the DFWP management plan, the USFS will issue permits based on the following criteria:

1. Permits will be issued only to outfitters who have operated on the river in at least two years during the 1983-87 period.
2. The total use assigned to outfitters will be based on historical use.
3. Allocation of use among outfitters will be based on their average use during the 1983-87 period.
4. Group size will not exceed 15 guests.
5. Permits will be issued only for activities directly related to river floating (no additional permits will be issued for big game hunting, etc.).
6. The permits will apply only to use of national forest land and will not preclude the DFWP from regulating outfitter use of the river should it be deemed necessary.

The DFWP management plan calls for continuation of the floater management program initiated in 1986. This program contains nine elements (see sidebar) and is designed to assist both floaters and landowners. Additional floating management regulations will be applied in stages as they are determined to be necessary.

RIVER CORRIDOR MANAGEMENT

The DFWP's river corridor management objectives outlined below, which can be achieved only through the voluntary cooperation of private landowners, are intended to protect the natural scenic integrity of the 61-mile segment of river most heavily used by floaters. For the stretches of river above and below the canyon (i.e., the 6.5 miles below Camp Baker, and the nine miles upstream from Eden Bridge), the corridor width is 500 feet on either side of the river. The objective is to preserve and protect the visual landscape by locating new structures, roads, and other physical alterations back away from the river corridor.

In the canyon proper (45.5 miles), the corridor width is one mile on either side of the river. The objectives here are: (1) to

FLOATER REGULATION

Steady growth in recreational use of the Smith suggests that a permit system may eventually be necessary. However, the management plan delineates several intermediate stages to be employed prior to the time that point is reached. The floating use for each previous season will be evaluated by October 1 of each year. If the management stage then in effect is no longer achieving the objective, the DFWP will propose moving to the next stage for the following float season. Public meetings will be conducted before final Fish and Game Commission action on the proposal by March 1 of the year in which the new management stage is to go into effect. The management stages are briefly described below:

Stage 1—Stage 1 will continue the management program initiated in 1986, which includes the following:

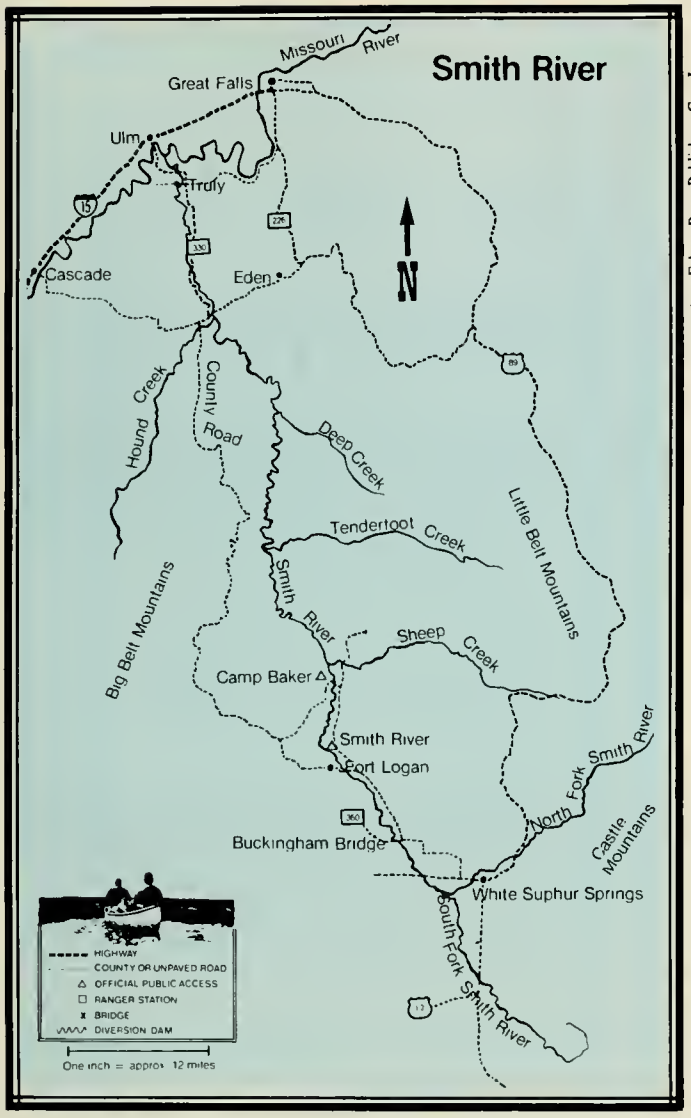
1. Voluntary reservation system—A reservation book is maintained in the department's Region 4 headquarters in Great Falls. Floaters are encouraged to phone this office (406/454-3441) and book their planned trips on the river. The reservation system helps floaters by telling them how many other people will be on the river during a specified time, allowing them to schedule their trip to avoid peak periods. It also allows the DFWP to advise floaters on river conditions and to discourage trips when reservations reach current river capacity. More than 85% of all floaters are now making use of the voluntary reservation system.
2. Seasonal river ranger—A full-time river ranger is stationed on the river for the entire float season to police floating use, assist floaters and landowners, maintain boat camps, install signs, etc.
3. Floater information and survey—The Good Sams Club in Great Falls and DFWP personnel maintain an around-the-clock presence at the Eden Bridge take-out during the peak of the floating season to interview floaters and complete floater survey forms. Good Sams are also often found during the float season at the Camp Baker put-in point, where they advise floaters on current river conditions.
4. Boat camp declaration at Camp Baker—Floaters indicate on a posted map at the time they launch where they intend to spend their first night on the river. This enables floaters launching later the same day to plan accordingly.
5. Sign program—Signs are placed and maintained where they are needed to assist floaters and landowners.
6. River guide brochure—The DFWP and the ad hoc committee developed a new river guide brochure which contains maps, advice, and do's and don'ts for floaters. It is available free at Camp Baker and at selected DFWP and USFS offices.
7. Creel survey—Survey cards are available at Camp Baker and fishermen are requested to complete them to assist the DFWP in managing the fishery.
8. Low-water advisory—The DFWP issues news release advisories as a service to floaters and to reduce inconvenience to landowners.
9. Ad hoc committee—The committee continues its advisory role to the DFWP.

Stage 2—This stage will be used when full-time interviewers are not available at Eden Bridge and/or to ease floaters into a registration/permit system. It continues the voluntary reservation system but adds at Camp Baker a mandatory registration system by means of a self-issued float permit that includes a floater's log to be left at Eden Bridge. This replaces the present user survey. This stage may also initiate use of a floater identification tag that can be attached to the float craft.

Stage 3—This stage will feature mandatory reservations for a set number of permits during the peak floating period (approximately Memorial Day to the Fourth of July). It will establish a maximum size for float parties. User fees and outfitter allocation will also be initiated. Float permits, float logs, and craft identification will be mailed to floaters after the reservations are booked and permit fees paid. For non-peak use periods, the program will revert to Stage 2 management.

Stage 4—This stage simply broadens the mandatory reservation system to the entire floating season.

Stage 5—This stage will be initiated if and when the total user demand exceeds the total annual number of user permits and the reservation system is judged to be no longer fair and effective. It will involve a process for allocating float permits for the season or individual time slots.



map courtesy Falcon Press Publishing Co., Inc.

restrict any development, construction, or vegetative or landscape alterations within 500 feet on either side of the river that would diminish the scenic integrity of the river, and (2) to preserve and protect the visual landscape for the balance of the corridor out to one mile on each side of the river.

Because the majority of lands within the corridor are privately owned, the potential exists for future changes in use and ownership. The DFWP, in cooperative efforts with private landowners, will utilize the following management tools to achieve these corridor objectives:

Conservation easements—Conservation easements have the potential for accomplishing all of the corridor objectives. The specific constraints or controls needed can be obtained without purchasing the land, and the land can still be used for agricultural purposes.

Land exchanges—Exchanges could help achieve management objectives in specific parts of the corridor. The first priority would be to secure boat camps in areas where they are needed. Preferably, exchanges would involve private lands on the river for public lands away from the river. Public lands that might be affected include national forest land, BLM land, school trust land, and lands managed by the DFWP.

Land purchase—This is likely to be a limited tool due to scarcity of funds.

Leases—Leases are a short-term management tool but can be used while more permanent solutions are being sought.

Donations—The DFWP will cooperate with outside groups seeking donations for preservation and protection of the Smith River corridor. A private group, "Friends of the Smith River," has recently been established and will raise funds to assist in accomplishing the corridor objectives.

Zoning—Meagher and Cascade counties are in support of corridor protection and are willing to establish zoning districts if the landowners so request.

Special designation—The DFWP will investigate the feasibility of having the legislature create a special designation for the river that could provide special funding or enhance the possibility of receiving cash or land donations.

OTHER MANAGEMENT

In addition to management of the river corridor, the DFWP management plan for the Smith addresses the issues of weed control, water quality, and water quantity. The DFWP is concerned about noxious weed problems and will work closely with the respective counties through cooperative agreements to control weeds on department lands in the corridor. The DFWP's water quality objective for the Smith is to maintain quality at or above the 1975-85 average level. Sedimentation caused by erosion from agricultural and forest lands is the most significant water quality problem, and the DFWP will cooperate with the conservation districts and the Water Quality Bureau to monitor water quality.

The greatest problem with water quantity is low summer flows which endanger the trout fishery and in some years reduce the length of the float season. The DFWP's objective is to ensure that flows do not fall below the 1976-86 average in the future. The DFWP will continue to work with the Newland Creek Water Users Association to purchase water in low-water years for the protection of the canyon fishery.

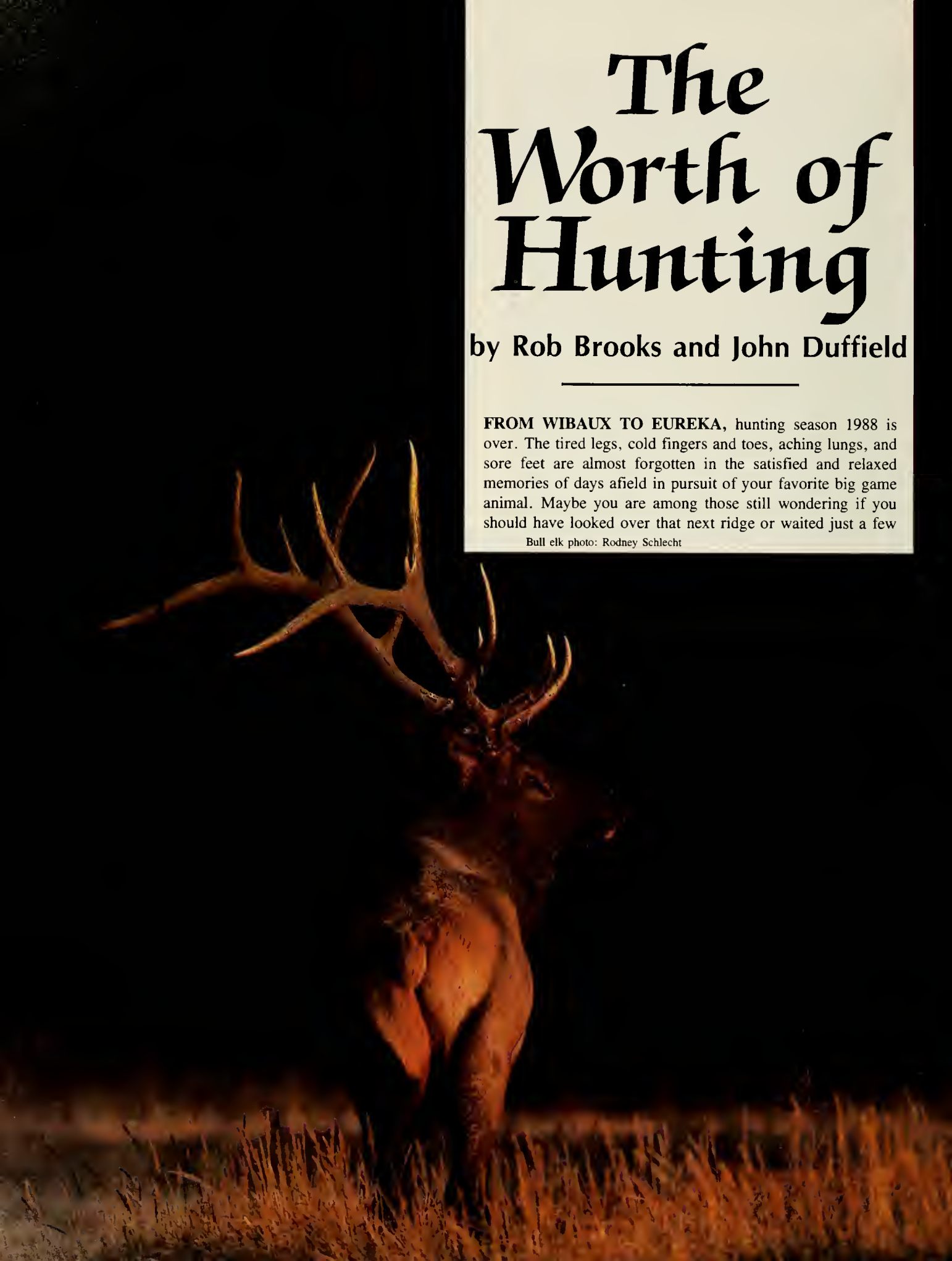
Management of the Smith River is handled through the DFWP's regional headquarters in Great Falls, with primary responsibility assigned to the regional parks manager. More information about the management plan can be obtained by contacting Dave Todd, Region 4 parks manager, Department of Fish, Wildlife and Parks, P.O. Box 6609; Great Falls, MT 59406 (406/454-3441).

The Smith River Management Plan has charted a course for the continued health and vitality of this unique recreational waterway, and has established a foundation upon which management plans for other significant river systems in Montana can be based. Despite the pressures of increasing popularity and use, the Smith can, through cooperative efforts of government, private landowners, and recreationists, provide quality fishing and floating in a near-wilderness setting for many generations to come.■

The Worth of Hunting

by Rob Brooks and John Duffield

FROM WIBAUX TO EUREKA, hunting season 1988 is over. The tired legs, cold fingers and toes, aching lungs, and sore feet are almost forgotten in the satisfied and relaxed memories of days afield in pursuit of your favorite big game animal. Maybe you are among those still wondering if you should have looked over that next ridge or waited just a few



Bull elk photo: Rodney Schlecht

minutes longer as darkness closed around you. Or you may be one of the lucky ones sitting in your easy chair smiling smugly at how right everything was this time. Downstairs is a freezer full of good eating and in your head and heart are wonderful memories of a successful big game season.

For those of us fortunate enough to take the opportunity to hunt Montana big game, it is difficult to relate to others the reasons why we torture ourselves so in the weeks the season is open. Crawling through alder west of the divide or out East glassing the breaks—there just isn't enough time to do it all. Whatever the species or setting, the reasons for hunting are in most cases personal and very strongly held. While much of modern life is calibrated by checkbook and cash register, hunting is a connection to a simpler time when experience and existence were more direct. So, it is difficult to put our experiences in the field into abstract dollars and cents terms. Nonetheless, in a variety of public and private natural resource contexts, the question is increasingly asked: What is hunting worth?

The answer is not straightforward, but the reasons for asking are becoming more and more apparent. Various competing groups are using and developing Montana's natural resources (fish, wildlife, timber, minerals, grasslands). The competition for these resources creates some difficult choices for land management agencies charged with managing the resources. Knowledge of economic values assists in this process because it helps managers determine which mix of resource use is in the best public interest. The Montana Bioeconomics Project was initiated by the Montana Department of Fish, Wildlife and Parks in fall 1985 to provide these economic values for fishing and hunting in Montana.

What is bioeconomics? In general terms, it is the study of the productive use of naturally occurring biological populations. Both biology and economics are needed to describe the interaction of human activity with fishery and wildlife resources. As an example, for any given hunting area in a given year, specific levels of big game populations, hunting pressure, and the resulting harvest are all interdependent and determined by factors as diverse as the reproductive rate of the herd and the proximity of the area to human population centers. Of course, not all the factors are predictable—like the timing of the first big snow in November.

THE MONTANA BIOECONOMICS PROJECT was designed to study recreationists' behavior to determine the economic value of elk, deer, and antelope hunting, and stream and lake fishing. In addition, the second phase of the study determined the preferences of elk hunters and trout stream fishermen. (Several earlier articles in *Montana Outdoors* have focused on the bioeconomics project: "Love Those Anglers!" March/April 1988; "Best of the Big Medicine," Sept./Oct. 1988; and Part One of this series, "The Worth of Fishing," Nov./Dec. 1988). The preference information provided not only an in-depth look at what motivates elk hunters but also insight into their views on specific elk management issues. Three economists—John Loomis, of the University of California at Davis, and the authors—along with a social psychologist, Stewart Allen of the University of Idaho, worked on the project.

How much is elk, deer, or antelope hunting worth to the sportsman? Based on surveys of resident and non-resident sportsmen, the average elk hunting trip is worth $185, while an average deer hunting trip is worth $108. The average antelope hunt is worth $143. Looking at these values another way, elk hunting is worth $66 per day, deer hunting is worth $55, and antelope hunting, $62. With over 1.5 million days afield for these three species, the annual value of elk, deer, and antelope hunting is $95 million. To understand what these per-day values represent it is important to understand how they are calculated.

For most of the natural resource-based commodities that provide value to Montanans, a readily observable market exists that determines prices (for example, the market for timber or minerals). No such observable market prices exist for hunting and fishing, but that doesn't mean these activities have no value to hunters or fishermen. To determine what hunting is worth in Montana requires an understanding of demand. Economists generally use two methods for estimating demand for non-market resources such as hunting: the travel cost method and the direct survey method. Put basically, in the travel cost method method, economists estimate a demand curve by examining the way in which the number of visits to a given recreation area declines with travel costs. The idea of the direct survey method is quite simple: If you want to know what people are willing to pay for something, ask them.

We used both methods to estimate demand for elk hunting, while we used only the travel cost method to estimate demand for deer and antelope hunting. The use of both methods for elk hunting provided the opportunity to compare results. Using the travel cost method, elk hunting is worth $185 per trip; using the direct survey method, elk hunting is worth $260 per trip. Why is there a difference in the estimates from these two methods? The travel cost method is based on actual observed behavior—dollars spent, distance traveled, and the number of hunting trips to a given area. However, Montana's special permit system (for example, cow tags in a specific hunting district) limits the number of hunters by area, sex of the animal, and date. The effect of these limits is that the travel cost model underestimates economic demand for elk hunting. Accordingly, travel cost model results may be regarded as conservative. So, it's not so surprising that the travel cost mode estimate of $185 is somewhat below the direct survey estimate of $260.

Interviewers contacted 2,000 licensed hunters by phone after the 1985 hunting season and asked them to describe their elk, deer, and antelope hunting trips that season. They provided information about out-of-pocket money spent for transportation, lodging, food and beverages, guides, and miscellaneous items, as well as how far they drove. It was no great surprise that non-resident hunters spent quite a bit more than their resident counterparts and drove quite a bit farther. Non-resident elk hunters spent $188 per day and typically made one seven-day hunting trip to Montana, including a round-trip drive of 2,900 miles. Resident elk hunters spent an

average of $40 per day afield and drove only 194 miles. Resident deer and antelope hunters spent about $55 per trip, while non-residents spent around $500 per trip.

At this point, you might be shaking your head and asking yourself: What is the difference between out-of-pocket expenses and what the hunting trip is worth? The out-of-pocket expenses are just that—expenses to the hunter. The average per-day values mentioned at the beginning of this article for elk ($66), deer ($55), and antelope ($62) hunting represent benefits to the sportsman. These values are what he would be *willing* to pay over and above his out-of-pocket costs.

WHILE THESE AVERAGE NUMBERS PROVIDE one measure of the importance of hunting to an individual, it's interesting also to look at the big picture. All those hunters with orange vests you see driving to or from their spot, all those antler-festooned garage doors, all the hunting stories shared around the table are indicators of how pervasive the hunting experience is in Montana's culture. Another measure is the amount of "personpower" that goes into this activity. For example, for the 1985 season, over 200,000 hunters spent over 1.5 million days hunting in Montana. To aid their pursuit of elk, deer, and antelope, they spent around $125 million on gasoline, food, lodging, guides, and equipment. Someone you may know might fantasize about what could be accomplished if this major expenditure of time and dollars were diverted to other less worthy ends, perhaps even washing the windows. But anyway you look at it—participating, opposing, or standing in awe—hunting is a major component of Montana's economic picture.

It's also interesting to see how hunting effort is allocated among species. In an average year, 15,000 to 20,000 elk are taken, 20,000 to 30,000 antelope, and 100,000 to 150,000 deer. In contrast with the major big game species, the moose, goat, and sheep harvest all added together is about the same as the total bear harvest—around 1,000 animals. While elk may account for less than 10% of the harvest, they are the focus of about 40% of the total number of days hunted. This reflects in part the difficulty of taking an elk (hunter success is 10% to 20%, as compared with over 70% for deer in some years, and over 90% for antelope). It may also indicate how highly prized the elk is as a game animal.

THE STATEWIDE AVERAGE VALUES for elk, deer, or antelope give us a broad picture of what hunting is worth, but site-specific values are much more useful in helping wildlife managers determine what makes one area worth more than another. These factors include hunter success, distance from home, access, number of animals, etc. The specific sites were defined by grouping together contiguous hunting districts that also had similar topography and hunter success rates. For example, the 129 elk hunting districts defined in the Montana hunting regulations were grouped into 21 different hunting areas. The value of these sites ranged from a low of $24 to a high of $112 per day for elk. The value for deer hunting across the sites ranged from $24 to $170, while antelope values varied from $50 to $90 per day.

Looking in greater detail at the elk hunting sites, areas with greater non-resident pressure had higher values. For example, the two areas with the lowest values were near Butte and Superior, while the most highly valued areas included the 400-series districts east of Great Falls, the Madison Range, and areas reached from Gardiner and Augusta.

As noted, the economic models were not able to fully reflect differences in values across sites because of the complex set of quotas for specific types of hunts (for example, cow permits or bull-only permits). Nonetheless, the studies underscore the considerable differences in values across sites. One reflection of this is the large number of applications for special permits in some districts. As an example, in 1985, District 447-02 was permit-only hunting in the Highwoods (east of Great Falls). A total of 1,582 residents and 49 non-residents applied for 100 permits—a 1 in 16 chance of success. Even more remarkable is the 764 applications for only 10 bull-only permits in District 631-01 (Charles M. Russell National Wildlife Refuge) in the Missouri River Breaks. You might call this a "long shot"—odds a little better than one in 100. Economists call it "excess demand." On these particular sites, hunting area dollar-per-day estimates are undoubtedly quite conservative.

GIVEN THAT A LOT OF MONTANA'S PRIME HUNTING COUNTRY (particularly for elk) is on public lands, what are the implications of this study's results for public land management decisions? The most visible public land manager in Montana is the U.S. Forest Service (USFS). This agency is required by federal law (Resource Planning Act of 1974) to compare economic benefits of fish, wildlife, and recreation with commodity values (timber, minerals, forage, etc.) in making forest planning decisions.

In USFS Region 1, which includes Montana, that agency values big game hunting "outings" at $13.60 (in 1982 dollars). After correcting for inflation, this value is about one-fourth of our approximate average of about $60 for a day of elk, deer, or antelope hunting. The USFS uses a value of $3.22 per outing for lake and stream fishing for resident fish; our estimated value for a day of lake fishing is close to $70 and for a day of stream fishing, about $100.

It is beyond the scope of this article to address the issue of why the USFS estimates are so much lower. One difference is in definition; the USFS estimates are for market clearing prices. In addition, the agency's values were based on averages from studies available seven years ago (in 1982), and none of the studies was specific to Montana. The point is that current USFS decisions are based on fish and wildlife values that may understate the full value of these resources. We expect these values will eventually be revised using more current information. An additional concern is that the agency uses the same value per day for all sites. As demonstrated by the examples used earlier, our research shows that some sites are considerably more valuable than others. The USFS uses site-specific characteristics such as the type of trees and the steepness of the terrain in estimating timber values for forest plans.

TO THIS POINT, WE HAVE DISCUSSED METHODS and results from the Montana Bioeconomics Project's hunting studies. Our non-market approach was necessitated by the fact that Montanans are blessed by an abundance of public lands and private landowners willing to open their lands to considerate hunters. Let's hope it stays that way. But just suppose, for the sake of argument, that hunting access in Montana was regulated by a fairly comprehensive market system. Would fees paid be in the same range as the values we have estimated?

The simplest market in hunting rights is the situation where individuals pay a fee for each hunting trip. This is common for deer hunters in Texas, for example. But when you think about it, the typical non-resident hunter visiting Montana is also likely to be in this situation. Most non-resident hunters make only one hunting trip to Montana and pay a considerable fee for the right to hunt—the state non-resident hunting license. That fee (currently $450 for the combination permit) is an indication of at least the minimum value a non-resident hunter places on a Montana hunting trip.

By looking at the variation in the number of licenses sold to non-residents over the years—at historically varying prices—one can get an idea of the relationship between price and number sold. From haircuts to gasoline, this is exactly the information economists use to identify market demand. For example, between 1970 and 1975, the non-resident combination license cost $151; the number sold grew from 9,500 in 1970 to 25,584 in 1975. In 1976, the price increased to $225. As you might expect, the number sold dropped considerably, to 12,689 licenses. With the price constant at $225, demand grew steadily, to 16,553 by 1978.

Since 1979, non-resident combination license sales have been limited by the 17,000 quota set by the state legislature. However, the prices and number of licenses sold from 1970 to 1978 were used in creating a statistical model for non-resident combination hunt demand in Montana. The model also took into account long-term effects on the hunting market such as income, population changes, or changing preferences. Basically, if you know the price, the model provides a simple method of predicting non-resident license sales.

Can such an economic model describe the reality of something as complex as the market for hunting permits? Certainly, such a simple model fails to include many possibly relevant factors. For example, a comprehensive assessment would have to recognize the regional market for hunting rights. Changes in the prices and availability of permits in Idaho, Wyoming, Utah, and Colorado certainly affect the Montana "non-resident permit market." Also, the model contains only eight years of data.

The model was tested by predicting non-resident combination license sales for 1987 and 1988. The model predicted that between 23,700 and 27,150 permits could have been sold at the 1987 price of $350. In fact, the DFWP recorded 24,148 permit applications in 1987 (although the quota of 17,000 was reached on the first day licenses were available). In short, the simple economic model did pretty well in bracketing the actual number of applications.

A more demanding test was predicting license sales for 1988, the year the non-resident price climbed to $450. The model predicted that around 16,000 permits would be sold—in other words, at the price of $450, the quota of 17,000 would not be reached for the first time in 10 years. In fact, as many readers already know, licenses did not sell out on the first day. Even after a few months, only around 15,000 had been sold. However, as word got around that Montana non-resident combination licenses were still available, they sold out on June 22. (An unknown here is the effect in 1988 of an additional 6,000 non-resident deer licenses.) Again, not too bad for a 1982 estimate fitted to 1970s data. One component of hunting behavior appears consistent with economic theory: the concept of an economic demand.

A final question is whether the non-resident permit demand model results in an estimate of *net* economic value (the value associated with the hunting trip over and above expenses—including the hunting permit) similar to the estimates arrived at by using the non-market methods discussed earlier. It's impossible to make an exact comparison since we have non-resident combination trips in one case and species-specific trips (elk, deer, or antelope) by all hunters in the other. For sake of comparison, let's assume that the value of combination trips mainly reflects the value of elk hunting and that non-residents and residents are otherwise basically similar. Then, as you may recall from the earlier estimate, applying the travel cost method to elk hunting results in an average net value for all hunters of around $185 per trip. The direct survey method resulted in an estimate for elk hunters of $260. When the model based on actual non-resident combination hunting license sales is used, the estimate is $155 to $180. These numbers are not identical, but certainly in the same range. Given the considerable differences in methods, the similarity in value suggests a measure of validity for the estimates.

To conclude, our studies demonstrate something Montanans have known all along: the fishing and hunting resources of this state are extremely valuable. By identifying the economic demand for these resources, we are able to provide dollar values that can be used in management decisions. The use of a variety of methods, including market information on license sales, is a sign that bioeconomics is an evolving field of study. The application of these methods in the Montana Bioeconomics Project was the most comprehensive study to date of a single state's fishery and wildlife resources. It has given us a very detailed snapshot for 1985 and 1986 of exactly who Montana anglers and hunters are and it tells us a great deal about their values, preferences, and attitudes. Perhaps the most exciting aspect of this work is that it gives us an excellent benchmark as we move into Montana's second century of fishing and hunting.

• *Part One of this series on bioeconomics, "The Worth of Fishing," appeared in the Nov./Dec. 1988 issue of* Montana Outdoors. *The information presented here and in the earlier article is merely a summary. If you're interested in copies of complete reports, contact the Department of Fish, Wildlife and Parks, 1420 East Sixth; Helena, MT 59620.*—Ed. ■

"Pane-ful" Tale of a Sage Hen

illustrated by Mike Mosolf

• *The following letter was sent to Art Warner, supervisor for the department's Glasgow region, last November. We thought the letter, from Hinsdale rancher William Court, and Warner's response would provide an interesting "Perspective" for our readers.*—Ed.

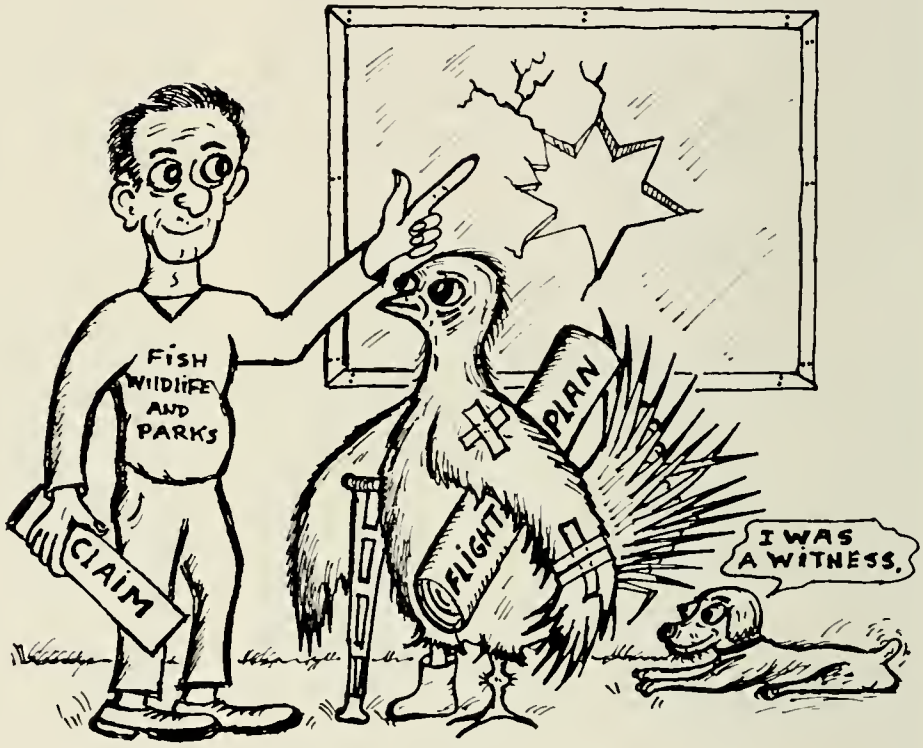
It is our hope that you can process this request locally; if not, please send it on to state headquarters at Helena.

Attached is a copy of a UBC sales ticket covering the payment by me of $220 for a CP25 Anderson window sash. This sash was installed in my home by me as a replacement for the identical one which was destroyed by the obviously defective and irresponsible flying ability of one of your prized members of the gallinaceous family, Tetraonidae, better known locally as a tough old sage hen.

The aforementioned destruction of the window by grossly negligent, reckless, and unlicensed flying occurred at approximately one hour after sunrise on the beautifully calm, bright, and clear morning of Tuesday, August 23, 1988. Weather, certainly, was not a contributing factor to the cause of the accident.

The impact of the mature bird, directly into the center of the picture window and breaking both the outer and inner panes of glass, created an unbelievably loud report and shock wave, not at all unlike that created by a low-level jet flying at or above sonic speed. Perhaps it wasn't heard around the world, but I'll bet that your biologist, Ron Stoneberg, who lives over six miles away could have heard it plainly (by the way, tell Ron to scratch one sage hen from his bird count tally).

The reasoning behind this letter and my claim for reimbursement is clearly that of **PRODUCT LIABILITY!** I'm sure you are familiar with the implications of product liability; if not, please consult with your attorney. In this particular case, we'll have to admit that the product, primarily, was created by the Almighty, whether in final or egg form, and it's obvious that because of sovereign immunity, we cannot and should not impose any liability upon the Creator. However, since there is an **implied** consensus of creation and ownership of said game bird by the Montana Department of Fish, Wildlife and Parks, there exists a secondary party to the case of liability—especially since one is required to have a valid license in hand before the taking of said bird for game or sport.



In re-creating the accident, all evidence points a finger at a malfunction in his navigational system which interfaces with his flight control system. When officials of the National Transportation Safety Board, Bird Division, conclude their study of the accident and release their findings as to the cause of the crash, they will undoubtedly label it as "pilot error" due to the fact there wasn't enough material remaining of the bird, except for the gizzard and a few feathers, to do a comprehensive autopsy in order to determine why and how he suffered system failure. The overriding reason that there was insufficient material remaining for study was because our dog, Bandy, a springer spaniel-blue

continued on page 22

Jim Flynn: A Good Job

Eight years ago, when Governor Ted Schwinden appointed Jim Flynn as director of the Montana Department of Fish, Wildlife and Parks, many sportsmen were concerned. Why, they asked, would the governor appoint someone with no natural resource background to head a wildlife agency, especially Montana's Department of Fish, Wildlife and Parks? After all, isn't Montana a state that by most standards provides some of the best hunting, fishing, and outdoor recreational opportunities in the nation?

When we asked Governor Schwinden why he appointed Jim Flynn, he said, "I trusted Jim and knew he would do a good job." How good a job Jim Flynn did can be measured in many ways. You can ask the people with whom he worked and the people who worked for him, or you can look at what he accomplished.

If you ask the people from other agencies and organizations who worked with Jim, their remarks are consistent: He was very effective, and his integrity and honesty were above question. If you ask the people who worked for him, they will tell you things like, "Jim was politically sensitive, legislatively astute, committed, a tireless worker, and an exceptional administrator."

If you ask the people *for* whom Jim worked—Montanans—you will find that while not everyone may have agreed with his style, most will say without hesitation that Jim was as good a director as the department has ever had.

But maybe the best way to evaluate an agency director's performance is to reflect on his accomplishments and to take stock of the resource following his tenure. In Jim's case, the record speaks positively. In addition to dealing effectively with controversial issues such as the re-opening of the Bighorn River to fishing, endrin, grizzly bears and wolves, stream access, non-resident licensing, and drought-related recreation closures, Jim implemented many programs, including an earmarked license fee that will raise between $2 million and $2.5 million annually for wildlife habitat in Montana. Such programs will benefit the wildlife resource for years to come.

Jim Flynn

In addition, hatcheries necessary for production of both cool- and warm-water fisheries are now in better shape than they have ever been, and Montana's fishermen will be the richer. Six of the department's seven old, outmoded headquarters have been replaced with new facilities of which Montana's sportsmen and women can rightfully be proud. The department's operating budgets, so vital for the day-to-day management of our fish and wildlife resources, are in better shape now than at any time in the department's history.

Jim's accomplishments are even more remarkable when you consider he took over an agency that had little credibility with the legislature and with many of the special-interest groups that have a stake in the affairs of the Montana Department of Fish, Wildlife and Parks.

As has always been his style, Jim left quietly, without fanfare, at the end of 1988 to return to private business in Anaconda. In his eight-year tenure, he did what Governor Schwinden said he knew he would do—a good job. All those who value the unique outdoor opportunities that make Montana such a special place to live or visit will benefit from the legacy that Jim Flynn left behind. We think he deserves special thanks for what he did on behalf of Montana's fish, wildlife, and parks resources.—*Dick Johnson, deputy director*

Montana Means Elk

Pick up almost any outdoor magazine and if you don't find it under the masthead, somewhere between the covers you will come upon a resplendent photograph of a Montana elk.

Montana's elk resource has become a standard of excellence among sportsmen. If you want to fly-fish for bonefish, you go to Christmas Island. If you want to hunt caribou, you go to the Northwest Territories. If you want to hunt elk, you come to Montana.

From the outside looking in, Montana can appear almost mythical in its abundance—still room to roam, wide margins, and all of that. But the fact is, we live in a time when Montanans are struggling to find ways to boost economic development while still maintaining a wildlife heritage as linked to the enjoyment of the outdoors as the Big Sky horizon is tied to the distant plains.

Over the past six months, the Department of Fish, Wildlife and Parks has been attempting to develop a balanced elk management plan to help maintain a part of that link. All Montanans and many non-resident sportsmen have been invited to become involved in the planning process that will usher the state's elk management program into the 21st century.

Because elk range over about 25% of Montana, from the forests of the northwest to eastern Montana's Missouri River Breaks, the DFWP set out to identify the issues that concern all Montanans—farmers and ranchers, sportsmen, educators, nature lovers, and business people. About 3,000 people have responded with comments and suggestions via phone calls, direct mailings, and public meetings.

John Mundinger, the Wildlife Divi-

sion's special projects supervisor, said elk management issues addressed during the planning stage include: elk numbers, areas best suited for elk, bull-to-cow ratios and other specific population information, habitat management on public lands, landowner tolerance of elk, hunting access, and length of the hunting season.

"We want to make sure that we have touched all the issues so that our elk management is responsive to the people of Montana," Mundinger said. "We want everybody's input. It doesn't matter if it's one landowner's concern or the concern of 1,000 sportsmen. A variety of people have a significant interest in elk management in Montana; we know this plan is going to touch many people's lives so we have asked them to become involved, and they have responded."

To help focus everyone's comments, Montana has been re-defined as 35 Elk Management Units (EMUs) of similar habitat type, terrain, land ownership patterns, and elk distribution patterns. Each EMU will eventually have its own management plan reflecting the physical characteristics of the area and the nature of the comments and issues identified by the public.

Mundinger said the DFWP has set out to identify the issues relative to elk management in Montana and to somehow incorporate them into the elk plan. "We went out to get that information because we wanted to do it right. We believe it's a better way of doing business."

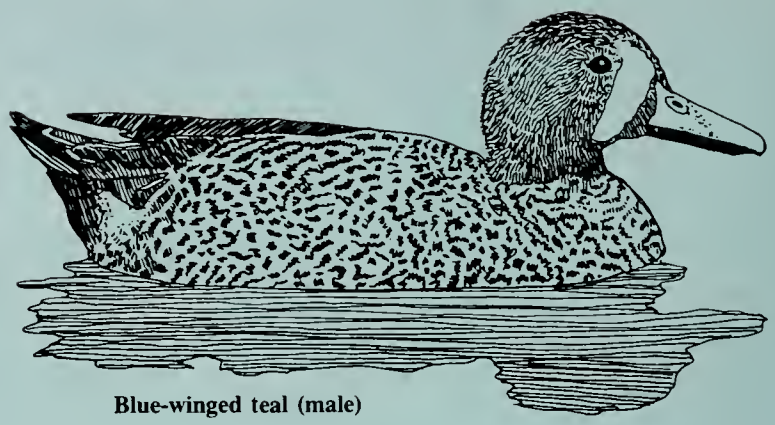
The draft management plan should be ready late this spring. The plan will be presented to the Montana Fish and Game Commission this summer.

For additional information or to provide comments, contact the DFWP Wildlife Division, 1420 East Sixth Avenue; Helena, MT 59620.—*Tom Palmer, information officer, Conservation Education Division, Helena*

DU Canyon Ferry Project Is "For the Birds"

The sage advice of most business analysts to the contrary, in some joint business ventures, cooperation is absolutely "for the birds." At least that's the way it's shaping up for some of Montana's waterfowl.

One such venture where cooperation was definitely "for the birds" can be found at the Canyon Ferry Wildlife Management Area (WMA) one mile north of Townsend. The wetlands enhancement project, developed through the cooperation of Ducks Unlimited, the nation's largest waterfowl conservation organization, and the Montana Department of Fish, Wildlife and Parks, was dedicated October 27, 1988.



Blue-winged teal (male)

Bolstered by $15,389 in matching funds from DU and money from Montana's waterfowl stamp program, the DFWP constructed two nine- and 12-acre ponds at the Canyon Ferry WMA. The Canyon Ferry WMA comprises nearly 7,000 acres; 2,000 acres of it are wetlands, adjacent to Canyon Ferry Reservoir and the Missouri River. The new ponds, which represent the heart of expanded wetlands enhancement effort at the WMA, will provide a variety of waterfowl (mallards, teal, and Canada geese) with increased nesting and brood-rearing habitat for years to come.

MARSH—or Matching Aid to Restore State's Habitat—provides state wildlife agencies with matching funds to be used in conserving local waterfowl habitat. Montana matches DU MARSH dollars with revenues generated from sale of the state waterfowl stamp and related items.

In addressing a gathering of approximately 60 media representatives, DU officials, and members of the public attending the afternoon dedication, Governor Ted Schwinden said the project represents "a very tangible effort to reverse the trend [of declining wetlands] so that Montanans can be better assured that we will maintain the variety of species that has been so important to our state.

"This dedication also celebrates a cooperative public-private effort to invest in the future of our state," he said, "in this case, our waterfowl resources. I'm convinced that by working together to fund and develop such habitat projects we can ensure that Montana will continue to be a desirable place for ducks and geese and other waterfowl to nest."

Since the MARSH program's inception in January of 1985, DU has committed over $30,000 of MARSH funds to the DFWP for wetland improvement projects. The Canyon Ferry project is one of three Montana projects that have utilized these funds. Three additional projects recently have received approval and approximately $51,000 from DU under the MARSH program. To date, DU has assisted in completion of 14 MARSH-funded projects throughout the Central Flyway, of which eastern Montana is a part.

The Canyon Ferry project is the 19th construction project that DU has completed in Montana under its expanding Habitat USA program.—*William G. Phippen, information officer, Conservation Education Division, Helena*

New Book Celebrates Montana's State Parks

The Department of Fish, Wildlife and Parks and Falcon Press Publishing Company of Helena and Billings have teamed up to produce a new Montana state parks guidebook. "Great Escapes—Montana State Parks" celebrates the beauty and resources of the state park system. The publishers hope the book will also instill an increased public awareness of—and appreciation for—state parks. Proceeds from its sale will also help underwrite future interpretive efforts at various parks.

The book, written by Helena freelance writer Rick Newby, contains nearly 100 color photographs of Montana's state parks and descriptions of what visitors will find at each.

According to Dave Conklin, chief of the department's Parks Program Development Bureau in Helena, sales of the book will not only provide revenue for future interpretive efforts at various parks, but also—and perhaps more important—enlighten those who read the book about the current plight of Montana's state parks system.

"We've felt for a long time that many people had only a superficial understanding of parks. We weren't telling them all of the opportunities that state parks can provide for the people of Montana, with the unique natural and cultural resources we have. That was our primary reason for publishing this book," Conklin said.

"What we're finding now is that we can't afford what we have." Conklin continued. "Water quality at some sites is deteriorating because of visitor overuse. And we don't have the manpower to preserve our non-renewable cultural resources. Without adequate protection, those resources will someday be gone."

Falcon Press Publisher Bill Schneider of Helena concurs that the real value of the book lies far beyond its pages. "Montana has a wonderful state park system," he said. "Yet, we've just been coasting along, kind of starving, for 20 years and now the state park system really needs help. The people of Montana, we think, will appreciate their state park system a lot more when they become familiar with it, and they will then want to help out in some way."

The 74-page book is available in a signed and numbered hard cover "deluxe" edition for $34 or a soft cover edition for $9.95 at all DFWP offices and many bookstores across the state.—*William G. Phippen, information officer, Conservation Education Division, Helena*

Dan Palmisciano: A Tribute

On December 20, 1988, cancer claimed the life of Daniel Palmisciano, wildlife laboratory supervisor for the Department of Fish, Wildlife and Parks in Bozeman.

Dan was born May 15, 1943, to Anthony and Dorothea Palmisciano in Providence, Rhode Island. He was graduated from Mount Pleasant High School in 1961.

Dan Palmisciano

Dan's educational background included a B.S. in zoology (1971) and an M.S. in animal physiology (1973) from Montana State University. He also completed three graduate wildlife courses in 1982-83 at MSU to improve his professional wildlife background and understanding.

His employment as a "wildlifer" began as a temporary laboratory assistant with the Montana Fish and Game Department in early 1965. He continued those part-time duties, as well as those of a check station attendant, through 1976. Dan also worked as a seasonal ranger in Yellowstone National Park during the summers of 1967-74; his duties included bear management and enforcing park laws.

He became a permanent DFWP employee in November 1977. He was promoted in 1979 and again in 1983 while working as a wildlife laboratory assistant. Dan was commended by DFWP Director Jim Flynn for his outstanding performance in resolving grizzly bear-human conflicts at Cooke City in August 1981.

Dan was promoted to wildlife laboratory supervisor in early 1986. He succeeded Ken Greer, who founded the lab in 1955 and retired in mid-1985.

Dan's specialty in wildlife physiology and forensics earned him a unique position with the DFWP. He identified species of animals from various body parts including hair and blood. His expertise was valued by the Veterinary Research and the Montana Livestock Diagnostic Laboratory at MSU and by the State Crime Laboratory in Missoula.

Dan was active in the Montana Chapter of The Wildlife Society, the Bear Biology Association, the National and Montana Trappers associations, and the Canadian Trapping Federation. He was an official scorer for both Boone and Crockett and Pope and Young.

In addition to trapping, hunting, and fishing, Dan was intensely interested in car and truck repair as a hobby. He successfully rebuilt numerous "wrecks," sometimes for friends and always for enjoyment.

In 1970, Dan married Donna Edwards of Missoula. Their daughter, Tracy, was born December 15, 1974. Dan is survived by Donna and Tracy in Bozeman; his parents; a brother, Albert; two sisters, Donna Octeau and Ann Bell; six nieces and nephews, all of Rhode Island; and the Edwards/Schmidt families of Missoula.

A friend described Dan as "being content with himself." While not aggressive, Dan felt strongly about demonstrating professionalism in all aspects of wildlife work. He worked toward competency and harmony in the department and provided specialized services to anyone requesting them.

Contributions to establish a student scholarship in Dan's name can be made to: Montana Chapter of The Wildlife Society, c/o Margaret Morelli, Department of Fish, Wildlife and Parks, Research Bureau, DFWP Building, MSU Campus; Bozeman, MT 59717-0001 (406/994-3285).

April Means Films

The 12th annual International Wildlife Film Festival will be conducted in Missoula April 3-9. The annual competition is the largest and longest running festival of its kind in the world, according to festival organizer Charles Jonkel.

Festival highlights this year include a wildlife photo contest, a course for amateurs in wildlife film making, a variety of panels and lectures, field trips—and, of course, some of the finest wildlife films in the world.

The festival's intent is to improve the quality of wildlife films or videos through this competition. For more information, contact the International Wildlife Film Festival, University of

Montana; Missoula, MT 59812, or call 406/243-2477.

Something to Sing About

Amid the bad news about declining numbers of songbirds in North America, ornithologists are finding a bright spot. According to the National Wildlife Federation, perhaps 20 varieties of songbirds seem to be expanding their ranges in this country, some at rates ornithologists describe as "dramatic," even "explosive."

As reported in the latest Canadian and U.S. Fish and Wildlife Service's Breeding Bird Survey, this expansion of songbirds—including northern cardinals, house finches, and American robins—is a pleasant contrast to ongoing declines in range and number of many other songbird species. (The range of a bird species refers to the geographic territory it occupies; an increase in range may or may not reflect an increase in the overall population of that species.)

Despite some wide-ranging scientific studies and hard statistics, the experts remain all but mystified. Some see the dramatic increase in the number of Americans who put out bird feeders during winter as a critical factor. Others cite a gradual warming trend in some regions. Still, even among the most pessimistic of ornithologists, there is consensus that range expansion is a reality. Among the species expanding their ranges are:

American robin: Unlike the cardinal and mockingbird, which are extending northward, the familiar American robin seems to be taking its caroling "tyeep, tut-tut-tut" call farther south into the Sun Belt. What makes the robin's expansion especially heartening is that it is partially the result of anti-DDT legislation. And as with cardinals, the relentless growth of suburbs, which create the parklike, lawn-dominated habitat the birds love, is contributing to their comeback and expansion. According to Texas A&M University ornithologist Keith Arnold, robins were uncommon in Texas in the 1970s. Now, he says, "the darned things are all over the place."

House finch: Originally western United States and Mexican birds, house finches were transported illegally to New York in the 1940s, and later turned loose. Today, the descendants of those birds are spreading their range as far south as Mississippi and into such midwestern states as Iowa and Nebraska. In fact, said U.S. Fish and Wildlife Service ornithologist Sam Droege, "in a few years, they should meet the native populations of the birds in the West. It's sort of like the transcontinental railroad."

The reasons for the species' exponential expansion remain unclear. Theoretically, the relatively dry, nearly treeless expanses of the Great Plains should serve as a natural ecological barrier to a bird that prefers a more humid climate and a habitat of deciduous forests broken by clearings. University of Washington ornithologist Tim Wootton believes that the increase in irrigated cropland in the southern Plains States may be providing the ambient humidity the finches need; he also speculates the species may be evolving in the direction of a more heat-tolerant bird.

Some other songbirds have also been expanding their range. The golden-crowned kinglet is moving south into the Piedmont areas of Maryland and Virginia, following, according to some observations, newly maturing plantations of Norway spruce trees that have been planted in large tracts around man-made reservoirs. Evening grosbeaks have moved east as far as Nova Scotia and New Brunswick, apparently pulled in part by the explosion of bird feeders.

Barn, cave, and cliff swallows are expanding in the South, thanks to a trend toward replacing round highway culverts with square ones, the corners of which provide ideal nesting sites.

Still, the songbird picture is by no means entirely rosy. According to Wilderness Society biologist David Wilcove, "Range expansion involves a relatively small number of successful species, as opposed to a number of species that are doing quite poorly."

Wilcove is particularly concerned about what he calls "serious declines" in a number of forest-loving songbird species: yellow-throated vireos, worm-eating warblers, and scarlet tanagers near urban areas of the East; golden-cheeked warblers and black-capped vireos in the West. "All these," he said, "have shown quite alarming declines. In fact, I'm concerned about the whole suite of forest-dwelling songbirds."

For the present, however, it appears that at least some species are doing quite well with or without human concern.—*National Wildlife*

KING OF BIRDS

AL HARMATA

by Al Harmata and Dennis Flath

THE EAGLE, long known as the "King of Birds," has fascinated and inspired mankind since ancient times. Because of its strength and lofty elegance, the golden eagle (*Aquila chrysaetos*) must be the species most responsible for this profound admiration. In fact, it is the most widespread eagle in Europe and often the only species found in countries whence fables of eagles came.

The golden eagle inhabits an impressive range—from the arctic to the subtropics around the world north of the equator. Five subspecies are recognized, each with an impressive geographic range of its own. To us, the familiar race is *Aquila chrysaetos canadensis*. It inhabits the Kamchatka Peninsula of Siberia in eastern Asia, as far south as northern Mongolia and Manchuria, and in North America from Alaska south to Durango, Mexico. It is rare in eastern North America where it differs from Montana's golden eagles; the eastern race is smaller, inhabits vast forests, and eats prey different from that of its western cousins. Information about the abundance of golden eagles is scarce, but one source suggests about 200,000 or more in North America, with over half a million worldwide.

In Montana, population densities of golden eagles vary depending on suitability of habitat and time of year. The Beaverhead-Madison area of southwestern Montana contains about one nesting pair per 65 square miles, but portions of extreme south central and southeastern Montana have densities up to one pair for every 16 square miles. Other areas in the state have lower densities, but even then the species is common.

Hundreds more golden eagles winter in Montana, and thousands pass through the state during spring and fall migration. Fred Tilly, an ardent hawk watcher from Arlee, has counted up to 117 golden eagles per day passing east of Rogers Pass and 818 over an 18-day period in March. In two weeks of late September and October, he has seen over 342 flying south along the ridge of the Bridger Mountains. Clearly, Mon-

tana is golden eagle country.

The golden eagle is named for the golden-hued feathers adorning the head and nape of the neck. These feathers fade, and in direct sunlight they contrast with the dark brown background of other feathers. From a distance, they sometimes appear almost white, leading to confusion with bald eagles which have a white head (see the sidebar for more information on how to distinguish between the two species). The tarsi (lower legs) of the golden eagle are feathered to the toes, in contrast to the naked lower legs of some other hawks and bald eagles. This may be an adaptation to living in cold, windy habitats.

While adult goldens can be easily confused with immature balds, identifying immature goldens (less than 4 years old) is easier. Newly fledged goldens are often nearly black overall, with the basal two-thirds of the tail feathers white with a broad terminal band of dark brown. The white base is obvious in flight, with individual feathers showing the familiar pattern associated with an Indian headdress. White bases on the wing feathers come together to form a patch near the middle of the wing. Attaining adult plumage takes three to four years, with a gradual reduction of white at each molt. As with most raptors, flight feathers of immature goldens are larger than those of adults. This probably gives the younger birds an advantage in flight efficiency while they are still hindered by inexperience and lack of coordination.

LIKE MOST PREDATORS, golden eagles have evolved specific attributes which allow them to detect, capture, kill, and eat prey. Most adaptations are obvious in the structures of the head, wings, tail, and of course, feet. In fact, by examining these structures closely, one can almost predict the habitat, habits, and food of many raptors, including eagles.

The eagle's most notable and valuable sense is its vision. The legendary powers of an eagle eye are ingrained in folklore, but often misunderstood. Acuity (sharpness of vision), not magnification, is the main attribute of the eagle's eye. No structures for magnification are

PETE AND ALICE BENGEYFIELD

Golden eagles generally nest on cliffs, but will use large trees where cliffs are not available.

AL HARMATA

The tail (above) of immature goldens less than 1 year old shows a broad, white band near the base. The white decreases with successive molts. The tail (below) of immature bald eagles displays a mottled pattern as opposed to the barred pattern of goldens. The white increases with age.

AL HARMATA

AL HARMATA

White bases of major wing feathers of immature golden eagles are apparent in flight.

present. The large size of the eagle's eye (almost twice the size of a human eye) permits a large image to be cast on the retina, and a high concentration of rods and cones gives the eagle its keen sight. Having such a large eye prevents movement in the socket. Thus, an eagle must move its entire head to look around. The distribution of rods and cones also allows eagles to detect prey by being extremely sensitive to the slightest movement or the color red. To demonstrate the visual acuity of an eagle's eye, consider this: At 400 meters, to a human, a cottonwood tree would be just a green mass of leaves; from the same distance, an eagle would see individual leaves, and possibly the veins!

CREATURES OF THE WIND, golden eagles are generally birds of open country. Their wings are longer and a bit narrower than those of an "average" hawk and allow effective use of wind currents for gliding and maneuverability. Golden eagles are most often seen soaring or coursing hillsides and hogbacks with little flapping, using the wind to the fullest extent. They fly less often into the wind than do bald eagles, using thermals and updrafts instead. In contrast, bald eagles with their shorter tails and broader wings are adapted for flapping flight; winds are seldom constant and predictable along river corridors and lake shores where bald eagles live. In strong winds, captive golden eagles become anxious, anticipating good flying weather—much like a good gun dog will start to whine when his master uncases his gun.

Eagles catch and kill prey with their feet, hence the name raptor—from the Latin "raptus" meaning "grasper." And, the foot of a golden eagle is a formidable weapon. Each of four toes is tipped with a sharp talon. The hind talon is the largest, easily two and one-half inches long. An eagle reportedly can exert a force of 1,400 pounds per square inch with its grasp, easily penetrating the skull of many mammals. Armed with these powerful weapons, golden eagles take prey ranging from small shrews to adult buck mule deer. The effect on big game populations, however, is negligible. An eagle will not often risk injury by attempting to take such large, healthy prey unless primary prey is extremely scarce or the weather severe.

The nest of a golden eagle is an impressive structure, often achieving huge proportions after years of use and accumulation of material. While bald eagles nest almost exclusively in trees, goldens prefer cliffs. However, in the absence of cliffs, the golden eagle will readily use trees; in Montana, goldens most often choose Douglas-fir, plains cottonwood, and ponderosa pine.

Golden eagles frequently have more than one nest in a territory, sometimes as many as eight. Goldens often switch nests, presumably to avoid the accumulation of mites, ticks, and lice brought to the nest in fur and feathers of prey. Consequently, a vacant nest used in a previous year does not necessarily mean the golden has abandoned the territory. Bald eagles generally have few alternate nests and coincidentally, their prey have few such parasites.

Early March is the time for golden eagle courtship and egg laying in Montana. Most goldens are incubating their eggs by mid-March. Biologists have often interpreted impressive undulating flights as courtship, but recent evidence suggests they are territorial displays directed at intruding eagles entering or approaching the territory. Evidence also suggests courtship in established pairs takes place year-round and is accomplished primarily by maintaining close proximity and through copulation. Clutch size ranges from one to three eggs, with two most common. Incubation takes about 35 days. Both adults share the task, but the bulk of that duty falls to the female. Brood size is usually one or two, but researchers have also documented several nests with three young in southwestern Montana, Colorado, and Wyoming.

When nestlings are small (less than four weeks old), the male seldom broods nor is he permitted in the nest for very long after he delivers food. His aggressiveness and predatory lifestyle might pose a threat to small nestlings. It also helps explain why female goldens (and indeed most female raptors) are as much as one-third larger than males. The larger female is capable of defending her young from possible aggression by her own mate. Indeed, females often chase males off the nest if they loiter too long!

The nestling period lasts about 10 to 14 weeks, but dependence of young on the adults extends up to eight months beyond fledging. Recently fledged young continue to beg food from adults, probably for as long as the adults tolerate it and it seems profitable to get a free meal without having to work for it! As the post-fledging period progresses, it becomes more difficult for the wide-ranging offspring to obtain food from the adults, and hunger forces the young to increase their foraging activities until they eventually achieve independence.

But the majority of golden eagles die before they enter the breeding population. Most often, the cause of death is starvation, but impact injuries, electrocution, and intentional shooting also take a toll. Examples of impact injuries include flying into a powerline or vehicle while chasing prey. Powerline design can reduce the electrocution hazard and improve opportunities for perching; however, many powerlines have not been modified and continue to present a hazard to eagles and other raptors.

Recent studies near Ringling, Montana, have revealed another potential problem for golden eagles—environmental contaminants. Previously thought to be immune because of food habits, golden eagles captured in spring of 1984-88 during the Valley of the Eagles Project (see the Al Harmata sidebar) showed troubling levels of heavy metals in their blood. Over 41% of all golden eagles sampled had lead residues in their blood considered toxic; all had detectable levels of selenium, many at or above toxic levels. Mercury was also present at levels previously unsuspected.

The implication of this contamination is unclear. Before this study, researchers believed bald eagles were most affected by lead poisoning because of their tendency to feed on crippled waterfowl, but balds sampled during the study were all below mean levels found

in goldens. Researchers know neither the source nor effects of the contamination, partly because results are from only a single sample from each bird. Is the heavy metal residue in blood increasing, decreasing, or chronic? What *is* known is that golden eagles with high lead levels showed a disproportionate number of foot lesions and their plumage was in poor condition. But, were these problems a result of lead reducing the eagles' fitness, resulting in more ground foraging? Or, did reduced fitness and ground foraging predispose eagles to ingestion of lead and other metals? Research continues on the incidence, severity, impact, and source of heavy metal contamination in golden eagles.

THROUGHOUT THE RANGE of the golden eagle, the mainstay of its diet is rabbits and hares. These, together with rodents, comprise 70% to 98% of the golden eagle's diet.

Although goldens capture and consume a wide diversity of prey, one Montana study showed rabbits and hares constituted 70% of the prey used. Additional studies in Montana and other western states show a similar heavy reliance on jackrabbits. Ground squirrels and prairie dogs are important in some areas or in years when rabbit densities are low. If given a choice, however, golden eagles seem to prefer rabbits because the thin skin is easily torn and they can acquire substantial food value for the amount of energy invested in capturing and consuming them.

When available, goldens use carrion extensively. Where winter mortality of big game animals occurs, use by golden eagles may be substantial. When the opportunity presents itself, goldens will take advantage of road kills, stillborn animals, gut piles, and other sources of ungulate carrion. In some instances, up to 60% of their winter diet may be carrion.

Contemporary legend greatly exaggerates the weight-lifting capabilities of eagles. Under optimum conditions (25 mile-per-hour headwinds), eagles can lift an equivalent of their own weight. However, in calm air, with only flapping flight for lift, eagles can seldom lift over four pounds.

GOLDEN EAGLES kill sheep. These depredations are primarily on lambs, but they occasionally take ewes. Some people believe that eagles don't kill sheep at all, while others believe all eagles kill sheep all the time everywhere. The truth, of course, is somewhere in the middle. It would seem, given the choice, an eagle would rather take a lamb than risk injury or loss of energy by attempting to take a jackrabbit. Jackrabbits are wild, tough, strong, fast, wary, hide from danger, and are cryptically colored. It takes an agile, smart predator to live on them—as most eagles do. Lambs under two weeks old are smaller than most adult jackrabbits and possess none of the defensive attributes of the wild hare. In fact, in most instances when a choice is available, golden eagles prefer jackrabbits—they probably taste better and eagles derive more energy from the meat.

Verification and assessment of eagle depredations are often based on misinterpretation of evidence. When people see an eagle feeding on a lamb, they often assume the eagle killed it. However, studies in Montana and Texas showed that lamb carcasses on which eagles fed were killed by eagles only 3% to 38% of the time. The majority of the lambs died from pneumonia. Lambs are fragile, and mortality rates from natural causes are high.

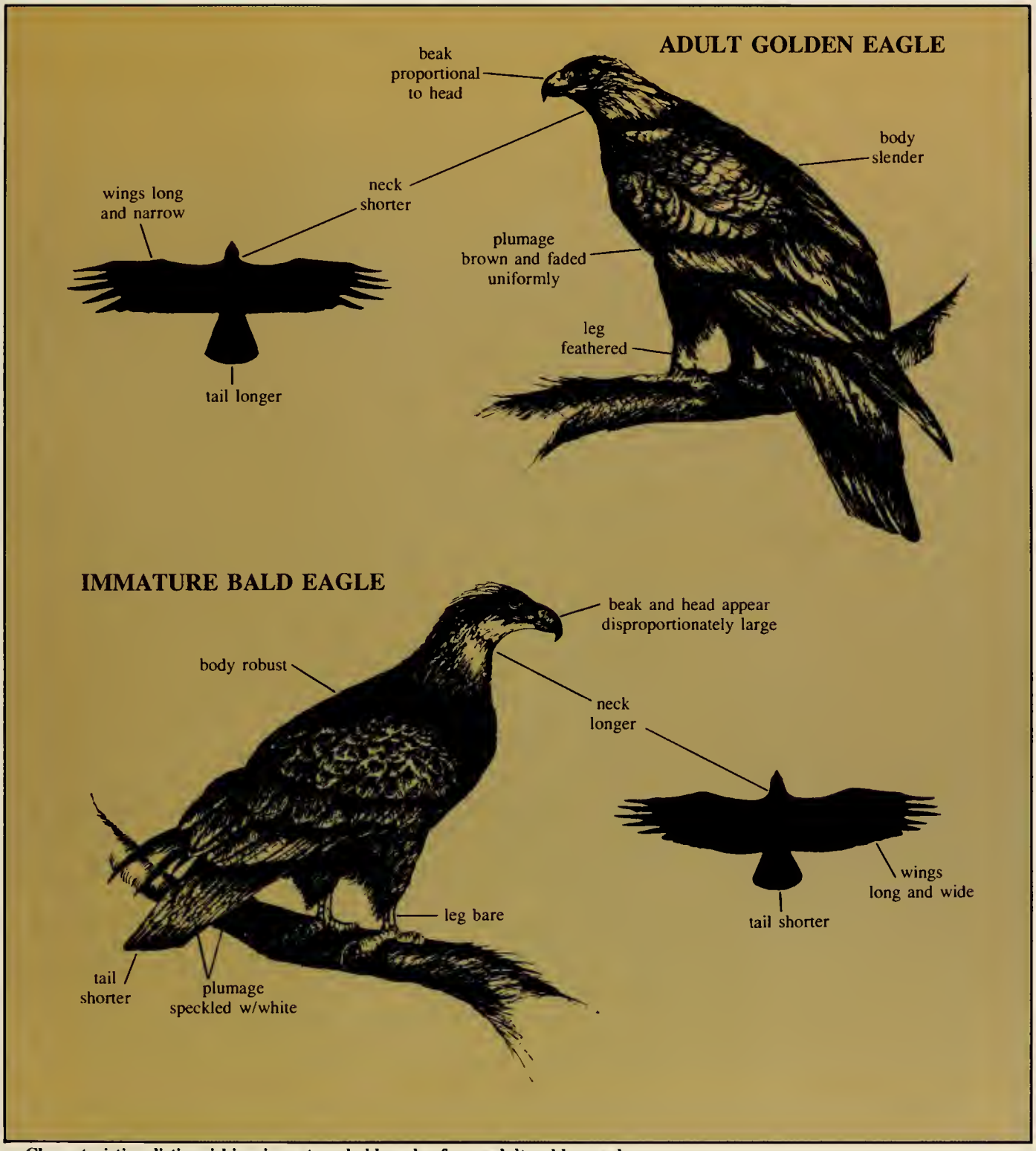
However, studies clearly show that in some areas under certain conditions, golden eagles may kill a significant portion (up to 25%) of an annual kid goat or lamb crop. The incidence and severity of livestock depredations depends on variables such as time of year, age, number and condition of eagles, location, timing and type of lambing (i.e., shed or range), weather, number and abundance of alternate prey species and status of local eagle populations (i.e., resident or migrants).

A lambing range in southwestern Montana provides an example. During the mid-1970s, a local rancher experienced severe sheep depredation problems. Several phenomena were responsible: The lambing range was directly beneath a major golden eagle spring migration corridor; the continental population of golden eagles had rebounded from the lows of the 1960s; jackrabbit populations had crashed over much of the West. Over 5,000 ewes were range lambing in April, just when migrating golden eagles were passing. The abundance of carrion from disease and other predators probably contributed to the attractiveness of the southwestern Montana range to golden eagles. Clearly, the rancher had a problem.

AS A RESULT of this and other documented livestock depredations by golden eagles in Colorado, New Mexico, Texas, and Wyoming, the U.S. Fish and Wildlife Service Animal Damage Control (now under the Department of Agriculture Animal and Plant Health Inspection Service) began capturing the goldens and relocating them. Between 1975 and 1983, 432 golden eagles were live-trapped in southwestern Montana and most relocated elsewhere. The program was fraught with controversy, and it was expensive and had questionable results. Some relocated eagles returned to the lambing areas within weeks. Were the captured eagles actually the ones killing lambs, or were the culprits avoiding capture? Were trapping operations contributing to the problem by actually drawing in eagles that otherwise would have overflown the area? Or, did captures represent just a small percentage of those usually present? In any event, captures and depredations declined after 1976.

In 1984, Bart O'Gara from the University of Montana experimented with alternative techniques to alleviate depredations. Most yielded inconclusive results. The most promising technique, however, proved to be none other than a simple scarecrow!

BOTH STATE AND FEDERAL laws provide for conservation of golden eagles. Federal laws include the Migratory Bird Treaty Act (MBTA) of 1918 and the Bald Eagle Protection Act (BEPA) of 1940. These laws both prohibit taking, possessing, transporting without a permit, or selling, barter-



Characteristics distinguishing immature bald eagles from adult golden eagles.

ing or purchasing eagles or their parts under any conditions. The BEPA was amended in 1962 specifically to include golden eagles. BEPA includes provisions common to the MBTA but it adds restrictions about molestation, harassment, and disturbance of eagles. The amendments to BEPA reflected concern for golden eagle populations thought to be declining at that time and the effects of similarity in appearance between golden eagles and immature bald eagles. Many young bald eagles were being misidentified and subsequently killed along with golden eagles in west Texas and New Mexico because of alleged depredations on sheep and goat herds.

Most violations of MBTA and BEPA such as killing, shooting, trapping, or possessing of birds or feathers without a permit are considered misdemeanors. Commercial activity is usually considered a felony. Montana law protecting golden eagles is under general wildlife statutes covering birds of prey. Most often, federal laws are applied due to their more restrictive conditions and severe penalties.

Legal protection may cause problems for resource development activities. Many golden eagles nest within coal and oil lease land in the West, and laws prohibit disturbance of the birds. Practical-minded wildlife managers, lawmakers, and resource development interests have cooperated to solve these problems. In areas of Montana and Wyoming where nesting golden eagles conflict with mines and wells, nests with young have been gradually moved away from the mine, allowing adult birds to return daily and successfully complete nesting. Successful reproduction in the shadow of resource development contributes to maintaining the integrity of the territory for the future for the birds, while reclamation standards require restoration of habitat, often with more long-term benefits for eagles and other wildlife.

In a few cases, some resourceful and tolerant golden eagle pairs have actually nested on high walls created by mining operations. This presents an interesting dilemma for resource managers. A conflict is created because reclamation standards require contouring of high

AL HARMATA: A Vision of Eagles

TOM PALMER

Al Harmata and friends.

"Raptors are like hot cars," Al Harmata said, dumping a spoon of instant coffee into a cup of hot water. "They draw egomaniacs. Just having these eagles here fulfills something in me, but I like to think that I don't exploit them."

Harmata keeps three eagles—two bald eagles and his beloved golden eagle—at his home at the foot of the Bridger Mountains near Bozeman. Sipping coffee and eating his breakfast bagel, Harmata watched the birds from the warmth of a kitchen that has acquired the ambience of a scientific bunker. Cabinets, makeshift desk tops, and shelves that may hold flour or canned goods in a different kitchen are stuffed with stacks of technical reports, field journals, topographic maps, and radio transmitters and receivers in Harmata's. A portable computer is tucked between a file cabinet and the refrigerator. The telephone provides regular and official interruptions.

Harmata is directing a $360,000 study of bald eagles within the Greater Yellowstone Ecosystem for the Wyoming Game and Fish Department. In the nation, only two other studies, the Arizona Bald Eagle Project and the Pit River (California) Bald Eagle Project, financed by the federal government and private industry, respectively, have benefited from higher levels of funding for eagle research.

The bald eagles Harmata is studying in Wyoming are apparently finding suitable digs in an area that covers portions of southwestern Montana, northwestern Wyoming, and eastern Idaho. The study area encompasses portions of Yellow-

stone and Grand Teton National parks, but it is becoming clear the eagles have established habitat borders that transcend state and national park boundaries.

"They are defining the limits of the ecosystem for us," Harmata said just as the phone rang. A researcher from the Wyoming project was having serious trouble keeping his trailer warm. Harmata, familiar with the trailer's moody heater and the relentless subzero nights of a Grand Teton winter, told the caller to relax because there was money to get the heater repaired. He laughed as he hung up the telephone, but it was a nervous, awkward laugh.

He said his whole career has been a fight for professional respect and now that he has attained it, he is beginning to feel too far removed from the real action. "Those are the guys who know the eagles now," Harmata said, tilting his head toward the phone.

Harmata, 43, has been studying eagles, falcons, hawks, and owls since 1971, when funding for raptor research was even harder to come by than it is today. In 1966, Harmata was drafted into the U.S. Army and served as an infantryman with the 1st Air Cavalry Division during the Vietnam War. His tour of duty literally cost him his left arm and leg, but those injuries afforded him the ability to finance some of his own research projects.

It is a high price for anyone to pay, but Harmata has little patience with anyone who would sentimentalize his war injuries and says matter of factly: "I can afford to study these birds. I can afford to put my own resources into them because there hasn't been, and there still isn't, enough federal or state money to do it. I used to feel guilty about using my own money, but now I can justify it in my own mind."

In academia, funding and designing one's own course of research is often looked at as a vainglorious pursuit. If a study is worthy, the ivory tower thinking goes, government agencies or private university benefactors will subsidize it.

Nevertheless, Harmata has persevered. He received his Ph.D. from Montana State University in 1983 and today he is widely recognized as a specialist in golden and bald eagle ecology, behavior, and biology.

One of his most dramatic studies—funded through public donations, Montana's Nongame Wildlife Program, Harmata's own out-of-pocket money, and personal donations from Department of Fish, Wildlife and Parks biologist John Ensign—has become known as the "Valley of the Eagles Project."

For the past five springs, Harmata and, depending on the weather, a slew of volunteers have taken blood samples from free-flying eagles trapped and banded near Ringling in west central Montana. The migrating eagles are measured, banded, some radio-tagged, and all tested for the presence of selenium, mercury, and lead in their blood systems.

The hard data recovered from the tests are disturbing. Harmata has found that nearly all of the sampled eagles have detectable levels of at least two of the metals in their blood systems. "If, in fact, we're sampling the whole population," Harmata said, "we're in trouble. All the eagles are carrying heavy metals."

The Valley of the Eagles Project's most surprising and troubling discovery is that over 41% of the golden eagles sampled are carrying toxic levels of lead in their systems. "All the lead poisoning hype is about bald eagles," Harmata said. "But we are finding that both incidence and magnitude of lead are higher in golden eagles than in bald eagles. What does that tell you? Well, we really don't know."

Over the past five years, Harmata has trapped too many sour-smelling golden eagles with foot lesions or badly swollen feet and dull, ratty plumage for him not to suspect that the toxic metals problem may be chronic. "But we've also caught some real gems," Harmata cautioned, "eagles that are round as an apple with incredible plumage and with that gleam in their eye. It's just too early to sound the alarm. That would be premature."

Dennis Flath, nongame biologist for the DFWP and long-time friend of Harmata, called Harmata's work with golden eagles one of a kind. "Al's contribution has been pretty substantial. He's looking at biological characteristics of the species that wouldn't be uncovered by research typically funded by agencies," Flath said. "It's a bit visionary. He's looking into the future by looking at the overall status and ecology of the golden eagle and the habitat the birds need to support themselves. He's dealing with a species within the context of its ecology, rather than a particular problem presented by a proposed mine or other development, and by doing that he's giving us a bigger picture to consider."

The birds do seem to drive Harmata. "Look at him," he said without couching his admiration. Out in the yard, the golden eagle was leaning into the wind, its wings tucked back and its head forward in a pose sharp enough to be stamped on a coin. "He is about as cool as they get."

Yet Harmata balks at any suggestion of an anthropomorphic connection between himself and the eagles. For instance, Harmata obviously has a deep affection for the birds he keeps at his home. But under the guise of science he has never named the eagles, even though he has charted a combined total of 20 years caring for them. He says the eagles are "lure birds" for his research, live eagles that serve to lure free-flying eagles in the same way duck decoys attract wild mallards.

"I do what I do because I'm interested in finding out what is going on," he said. "If lead or other environmental contaminants are turning up in golden eagles, it's not going to do the human population any good because we are drinking the same water and living off the same land they are. The concept that eagles, as high-level carnivores, are indicators of the health of our environment seems kind of trite, but it doesn't make it any less valid. If there is something wrong with these animals, something is wrong with the environment and that is something everyone ought to be concerned about."—*Tom Palmer, information officer, Conservation Education Division, Helena*

walls (near-vertical faces), but federal law prohibits destruction of occupied nest sites. High walls have been left for eagles in some of these situations as a test case.

IN DISTANT TIMES, before the advent of firearms, hunting with trained raptors (called falconry) was an efficient and effective method of acquiring game. The most spectacular use of golden eagles in falconry was practiced by the Mongols of central Asia, and the use may persist to this day. The Kirghiz people of Turkestan used the largest subspecies of golden eagle, the Berkut (pronounced "Bear-koot") to catch wild canids for pelts—mostly corsac foxes but often wolves. Although the central Asian wolf is much less formidable than our gray wolf, it was no small feat for an eagle to capture a snarling creature much larger than itself.

Eagles used for wolf hunting were taken from the nest at about 9 weeks and trained to attack lures of stuffed fox or wolf pelts. After becoming proficient, the eagle was "entered" on live quarry. First, the eagle was deprived of food until it entered a hunger-induced behavioral state known as "yarak." An eagle in yarak is an impressive sight and one to avoid. Eyes burning, head extended, neck hooked, chest out, hackles raised, and feet anxiously kneading the glove or perch, it is the embodiment of sheer power and instinct to kill. Once the eagle entered yarak, a young fox or young wolf was released near the eagle. When the eagle was cast off, it quickly overtook the quarry and killed it. It was not allowed to feed but was quickly taken up by the falconer and rewarded with a "full gorge" of food. Once trained in such a way, seasoned Berkuts, usually females weighing up to 18 pounds, would kill up to 50 foxes per year.

Wolves, however, were a different matter. Legends abound in falconry circles of the feats of wolf-killing eagles. What is seldom explicit, however, is how many eagles a falconer would lose to wolves before he acquired one that would adeptly seize and hold a wolf. In fact, an eagle would seldom kill a wolf but hold it until the falconer arrived to dispatch it with bow, gun, or knife. One 12-year-old eagle captured 14 wolves in one day, but one falconer lost 11 eagles to one wolf. Golden eagles have been used in falconry for centuries, but until recent history, only kings and nobility were permitted to possess them. Eagles are still used for falconry, primarily in Germany and Austria. In the United States, federal and state laws now permit the taking and possession of golden eagles for falconry. But fewer than 25 people practice falconry with golden eagles in this country, and most are also involved in raptor research. The low number is partly due to legal restraints but mostly to the difficulty of feeding, housing, handling, and flying such a large raptor. Only eagles captured by the U.S. Department of Agriculture Animal and Plant Health Inspection Service in areas of documented livestock depredations can be used.

The golden eagle is no less impressive today than it was in the days of the great Khan. To watch a golden eagle soaring 1,500 feet above your head, waiting for its quarry, then diving on folded wings for the kill is a sight to behold and a thrill unsurpassed. The King of Birds still has the power to fascinate and inspire the earth-bound hunter.■

"Pane-ful Tale of a Sage Hen

continued from page 10

heeler cross, very quickly dispatched the fluttering bird shortly after the collision.

In trying to second-guess the reason for the crash and his system failure, serious questions come to mind. Did he become a kamikaze pilot and commit suicide? If so, why? Did he have a bad experience in his love life earlier this year? Did he hear it was going to be a long, hard winter? Did he sense that hunting season was to begin shortly? Or did he simply have a desire to become a free agent not beholden to anyone, including the DFWP?

I could go on and relate more details of the event—such as the trauma to us which was created every morning, noon, and evening as we stared at a shattered and taped window, trying to enjoy our meal only to suffer indigestion as we awaited the delayed arrival of our new window. Other thoughts come to mind, such as the horror that our Bandy might be served with a summons and be heavily fined for consuming a game bird out of season!

I'll close with just one question: Was your bird fully insured for collision and damage to uninsured property? The reason I ask is that our window was not covered as we have a $250 deductible clause on glass breakage in our policy. You will note there is no charge for installation of the window by us. Payment for the reimbursement of the window can be either by cash or check.

Thanking you in advance, please send payment to...*William J. Court; Hinsdale, Montana 59241*

* * * * *

Thank you for the interesting letter...concerning your broken picture window. Unfortunately, there are no provisions in state law that will allow us to honor your claim.

I can imagine the shock you must have felt when a sage hen, of all things, came flying through both panes of a picture window on your house. I know of other birds that have flown into lighted windows at night, but that usually causes damage only to the bird.

As for the forlorn love life of the grouse going sour and the bird committing suicide, that is perhaps a question better answered by Ann Landers. However, your knowledge of sage grouse flying through closed picture windows probably exceeds that of any other expert.

Over the years, I have seen hunters use many ingenious ways of taking wildlife, but this is the first that I am aware of a person bagging a sage grouse by placing a picture window in its flight path. If you can repeat that a second time, it would surely go into the "Guinness Book of World Records."

I will forward your letter to our Helena office for additional review.—*Art Warner, DFWP supervisor, Region 6 (Glasgow)*■

READERS RESPOND

Photo Issue: Extra Special

Your Special Photo Issue (Jan./Feb. 1989) is the most beautiful ever produced. The addition of messages from former governors made this issue *extra* special.

Having been born in Manhattan and raised in the wheat ranch country of Gallatin County, I've always had a special affinity for all matters concerning the Treasure State, even though our family moved to Washington in 1930.

I hope present and future governing bodies continue to protect the natural resources of my home state for ensuing generations. Many of us appreciate the value of regulating industry and land use in order to preserve as much of the state's pristine values as possible.

The extremes in topography together with the extremes in the weather provide the basis for what makes Montana unique.

May we in the next 100 years prove to be as aware of the treasure that's contained within its borders as those whose messages were included in this special issue of *Montana Outdoors*.

My hat is off to the photographers who captured such magnificent scenes of the Montana landscape.—*Betty J. Martin; Tumwater, Washington*

* * * * *

My congratulations on the outstanding Special Photo Issue in this Centennial year. I would like very much to share this issue with my son, daughter, and brother in Oklahoma, Washington, and California.—*Ann M. Gulbrandsen, Great Falls*

Muskrat—No Rat

Thank you for Mark Bennett's factual portrayal of the most abundant North American furbearer—the muskrat ("Muskrat for Mascot," *Montana Outdoors*, July/August 1988).

Often overlooked, perhaps because of the last three letters of its common name, this aquatic rodent is found in every state except Florida.

The muskrat is responsible for instilling an early respect for nature in many young trappers, waterfowlers, and fishermen. Like all our other renewable natural resources, the muskrat provides enjoyment, recreation, and income to many of Montana's citizens.—*Dave Pauli, Billings*

* * * * *

The muskrat article in your July/August issue is the best I ever remember reading about 'rats.

I'm quite well acquainted with the muskrat, having trapped them and most other furbearers since I was a kid.

In the list of food that muskrats eat, I was surprised that the author did not mention freshwater clams or mussels. Here in Vermont, there are freshwater clams in practically all lakes, ponds, rivers, and streams. Muskrats eat them regularly.

I wonder if possibly there are no clams in Montana, or if Mr. Bennett just forgot to mention them. I have often wondered how many dollars worth of pearls have been lost from clams opened by muskrats over the years. I had an uncle who had a *small* bottle half full of pearls he had found in clams here in Vermont. I've opened hundreds of clams myself, but never found but *one* pearl. It was about the size of a No. 4 shot.—*R.G. Perry; Newport, Vermont*

• *Montana does in fact have freshwater clams; they are found in many bodies of water, including throughout most of the Missouri River drainage. Some of the clams have a rough, pearl-like mass in them.*—Ed.

Snow and Fire

I wrote "Snow and Fire" the night of September 18, 1988, as the snowstorm hit Helena. It deals with the positive effects of the snow as regards fire control and the beginning of the regeneration process for the forests that have been burned.—*Edward Kennedy, Helena*

Snow and Fire

The frigid sky sprinkling
The falling fragile flakes of snow.
Laid down a pure cool cover—
Soothing the winds of fire.

The black, bent, broken,
Burnt beauty of nature—
Gently massaged and mended
By God's virgin blanket of snow.

Nature's hot fire of purification
Contained, cooled, calmed to provide—
The signal of a new beginning,
A rebirth of the forest's splendor.

A miracle is wrought this night—
The scorched, scarred earth is cleansed,
Restoring the natural rhythms of life—
All nature perfectly integrated—born again.

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BOOK REVIEWS

TIMES AND PLACES, HOME AND AWAY: A Life of Freelancing in the Outdoors, by Charles F. Waterman, GSJ Press, 205 Willow Street, South Hamilton, MA 01982; 1988, 271 pages, $25 hard cover, plus $2.50 postage.

If you're a serious student of outdoor literature, you're probably familiar with Charley Waterman's by-line. A talented and prolific outdoor writer, he has authored 14 books and hundreds of magazine articles over a career spanning four decades, and he's still going strong. What you probably don't know about Charley is that he's been, among other things, a professional wrestler, a combat photographer in World War II, a competitive pistol shooter, a fishing guide, and a private detective. All this, and more, is detailed in Charley's autobiography, "Times and Places, Home and Away: A Life of Freelancing in the Outdoors."

Charley doesn't claim that outdoor writing is a profession of great global importance—only that it's interesting. In his typical tongue-in-cheek style, he explains: "Ordinarily, I'd say that it takes a lot of nerve for anybody to write about his life unless he is a public hero, an entertainer, a political leader or a business success, or unless he has lived a very unique life....[But] all of the rules can be suspended in the outdoor writing business for people are curious about outdoor writers. This is not necessarily flattering to hook and bullet authors because people are also curious about howler monkeys and jewel thieves...."

Many hunters and fishermen dream longingly of a life in the Great Outdoors—of getting rich from the written accounts of their exploits and basking in the adulation of their loyal readers. Charley takes pains to point out that the dream doesn't usually mesh too closely with reality, even if you are lucky enough to make a go of it: "I recall that in the bad old days we felt guilty when we were actually fishing and hunting because it was necessary to type around a million words a year to make a skimpy living....I was around 50 years old when it occurred to me that there was no doubt where our next meal was coming from and that as long as I kept typing we might be able to go pretty much where we liked to fish or hunt."

Indeed, Charley and his wife Debie have traveled to such far-flung and exotic places as Argentina, New Zealand, Honduras, British Columbia, Bermuda, Newfoundland, and Alaska in pursuit of elusive quarry like salmon, steelhead, bonefish, tarpon, Stone sheep, mountain goat, moose, and elk. But mostly it's been Florida and Montana, and places in between, for trout and bass, partridge and quail, deer and antelope. One gets the idea that Charley, despite the globetrotting, is just as happy throwing a bass bug on a smallmouth river or following his Brittany spaniel through a quail cover as he is on a fancy, fly-in hunt for sheep or moose.

This autobiography paints a portrait of a man born with a journalist's curiosity and an adventurer's itchy feet, but with the energy, discipline, and determination to live out a dream that he admits started at the tender age of 7, fishing for sunfish and bullheads in a Kansas farm pond. Through it all, it is obvious that Charley didn't do it for money or fame, or for trophy fish or record-book heads. He did it for the simple joy of hunting and fishing, and for the fun of telling someone about it.—*Dave Books, editor*

THE GREAT COOKBOOK ENTERTAINER, compiled by the Buffalo Bill Historical Center, P.O. Box 2630C, Cody, WY 82414; 1986, 312 pages, $12.95 soft cover, plus $1.75 postage.

If you are a connoisseur of great cookbooks, this one should be on your shelf. Pleasant to look at and easy to use, it contains a wealth of excellent recipes, covering everything from veal with strawberries, to salmon-stuffed trout, to pretzels.

Especially noteworthy are the sections on camp cooking and game dishes. The urge to find some unusual ways to fix that venison usually sets in about the fourth or fifth time you take it out of a freezer chock full of wild game. Barbecued venison kabobs or Greek stew just might turn your basic meal into a gourmand's delight. One of my favorites from this cookbook is:

Pheasant Soup

1 pheasant
4 Tablespoons butter
4 Tablespoons minced lean ham
1 onion, sliced
4 Tablespoons flour
1 bouquet garni
6 cups chicken stock
2 teaspoons ketchup
1/4 teaspoon celery salt
1/4 teaspoon pepper
1 Tablespoon finely chopped truffles or dried mushrooms
1/2 cup sherry
1/2 cup cream

Roast the pheasant until nearly done. Remove and shred breast meat. Melt butter and saute ham and onion until light brown. Add flour and brown slightly. Add bouquet garni, stock, ketchup, celery salt, pepper, and quartered bird carcass together with the shredded meat and truffles. Simmer 1 hour and skim well. Remove carcass and bouquet garni, add the sherry and cream and cook 5 minutes. Serves 4.—*William E. Weiss; Cody, Wyoming*

Add to this a warm loaf of French bread, a bottle of wine...food to warm the soul on a wintry, starry Montana night.

One bonus with this cookbook: Proceeds from sale support the ongoing projects and programs of the Buffalo Bill Historical Center in Cody.—*Donita Sexton, art director*

JUST DOGS, Willow Creek Press, P.O. Box 300, Wautoma, WI 54982; 1988, 148 pages, $35 hard cover.

This book bears the subtitle, "A Literary and Photographic Tribute to the Great Hunting Breeds." It's all of that, and more. The editors say it best in the Foreword: "The hunter who sees his dog as only an animal, another tool of the hunt, like a shotgun or a pair of boots, won't appreciate what appears on the pages of 'Just Dogs.' But anyone whose Ben, Maggie, Parker, Thor, or Sally was ever at once his friend as well as his hunting partner, anyone who has ever looked into the eyes of his dog and seen there the soft, sweet look of fondness, of forgiving, infinite devotion, and felt that gaze all the way into his heart, will know what this book is all about."

It's mostly a book of photographs—Labs, goldens, springers, setters, pointers, Britts, and all the rest—but there are birds and hunters and shotguns,

too—all the images that evoke the autumn majesty of the bird hunter's world. The photography is stunning and the text well chosen, the latter comprised of excerpts, essays, and stories by such past and present bird-hunting luminaries as Burton Spiller, Corey Ford, Nash Buckingham, Gene Hill, and George Bird Evans. The result is a pleasant blend of pictures and words guaranteed to shorten the interminable wait between the closing of one hunting season and the opening of another.—*Dave Books, editor*

BRONC TO BREAKFAST & Other Poems, by Mike Logan, Buglin' Bull Press, 32 South Howie, Helena, MT 59601; 1988, 76 pages, $6.95 soft cover, plus $1.50 postage.

The price of $6.95 seems fair for a lighthearted look at the cowboy side of life through the medium of poetry. Mike Logan, the author, is an accomplished yarn-spinner and photographer whose photos and words have graced many of our issues.

His gentle, good-natured way of looking at life is evident in his verse. Take, for example, a portion of:

Ol' Cooky

Now, Ol' Cooky was some ugly
An' he surely weren't no rose.
If you lost him in a stampede
You could find him with your nose.

Cooky wasn't scared of water.
Shoot, he used it ever' day
Makin' coffee, beans and biscuits,
But wash in it? No way!!!

Now I ain't faultin' Cooky.
He could sure 'nuff rustle grub.
But he'd get just plain insulted
At the mention of a tub.

Cooky's apple pie was heaven.
It just seemed some angel's blend.
Punchers purt' near fought for seconds,
But they always ate upwind.

Cooky's wagon, it was spotless.
Plate and cups was shiny clean.
But you just mention bathin'
An' Ol' Cooky'd get plumb mean....

Now, if those lines don't put a smile on your face, I don't know what will.

The bonus with "Bronc to Breakfast" is some mighty fine pen and ink sketches by Mike Korn—folklorist, writer, musician. Folks, it boils down to this: "Bronc to Breakfast" is a great deal and it provides reading a good deal more pleasant than most newspaper headlines these days.—*Donita Sexton, art director*

MAKE ME A MOOSE! With No Fleas, Please, by Mark Henckel, illustrated by John Potter, Outlaw Books, P.O. Box 4466, Bozeman, Montana 59772; 1988, 32 pages, full color throughout, $4.95 soft cover.

I don't have little people at my house. But if I did, I'd make sure to take along a copy of "Make Me a Moose!" on our next car trip. Or I'd take it off the shelf when they were having one of "those" afternoons—when the patience supply runs thin. As a matter of fact, it would be a great book to share with just about ANYONE who needs a dash of good humor.

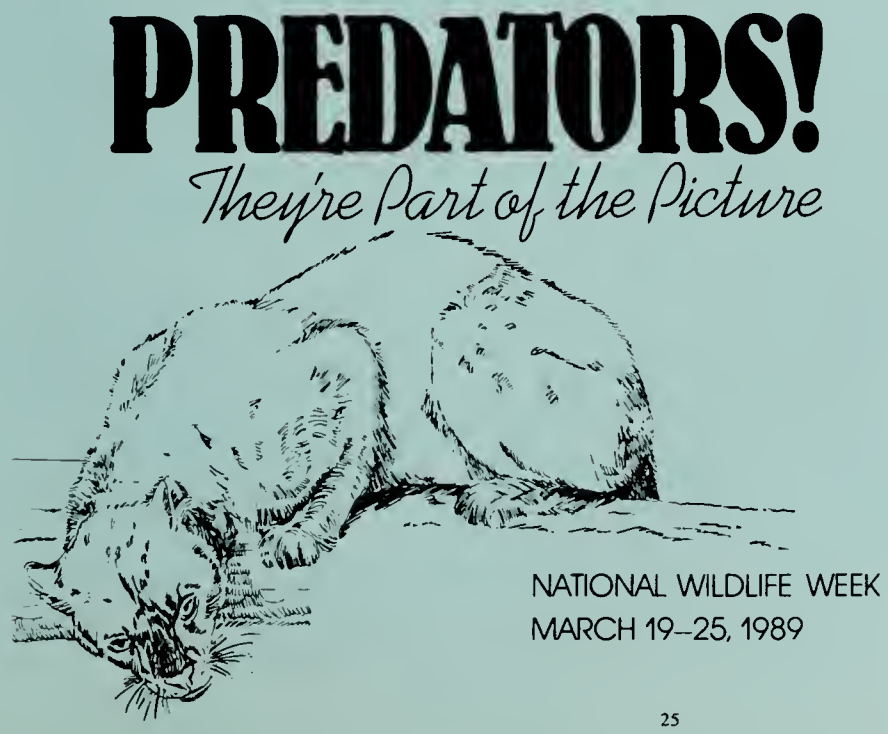
It tells the story of a boy trapped in the backseat of a car with—of all things—his SISTER on a long, long, long, family vacation. As Henckel writes:

"Trapped in a car is no place to be,
No place at least, for my sister and me.
Have fun, they say, the folks in the front,
Then they get mad, if you laugh loud or grunt."

As the trip unfolds, so does the boy's imagination. He envisions himself as a squirrel, rabbit, trout, bug, bear, hawk, snake, duck, deer, and—naturally—a moose. In clever, amusing rhyme, Henckel provides accurate details about the needs of the aforementioned creatures, and some others as well.

So it's educational. It's fun to read—or have someone read to you. And the lively color illustrations make it a joy to look at as well. Henckel is the outdoor editor of the Billings Gazette, and he has won many state, regional, and national awards, including recognition from the Outdoor Writers Association of America. His writing has appeared in these pages (most recently, in Nov./Dec. 1988, "These Trails Were Walked Before," a chapter from his new book, "The Elk Hunter," co-authored with Don Laubach). He has also written "The Hunter's Guide to Montana" and co-authored "Elk Talk" with Laubach. Potter is an award-winning Chippewa Indian artist who has been drawing and painting since he was 3 years old. His work hangs in private collections, and it has appeared in our pages previously (most recently in Nov./Dec. 1988, illustrating the Laubach/Henckel article). Potter is editorial artist at the Billings Gazette. Between the two, they have four sons and a wealth of outdoor, family, and humorous experience on which to draw.

For $4.95, consider "Make Me a Moose!" for anyone on your gift list, age 2 to 7. Or, for that matter, 22 to 77. And be prepared—a sequel, "Sis' Revenge: Oh Brother, This is Fishing," is due in April. And then in October, the Henckel/Potter Outdoor Family Series will continue with "It's Tough to be Small in the Big Outdoors."—*Kay Morton Ellerhoff, associate editor*



CONTRIBUTORS

• Come spring in Montana and the word on the lips of anyone even remotely interested in floating and fishing is: *Smith*. If they've been there before, the focus is "Revisiting the Smith." If they're first-timers, they talk to the old hands about how much time from here to there, where to take out the first day, whether June 9 or June 16 is the better weekend. As **Joel Shouse** writes, the Smith "flows through a deep limestone canyon in a near-wilderness setting abounding with wildlife." Add to that its top-notch floating and fishing opportunities, and you begin to understand its drawing power. That's why it needs special attention to preserve and protect it. For example, a seasonal river ranger patrols the most heavily floated section. A committee advises the Department of Fish, Wildlife and Parks on the river's management. And a formal management plan for it has been endorsed by the Fish and Game Commission. Shouse is an engineering, planning, management, and environmental consultant in Bozeman. He was retained by the DFWP to conduct Smith River studies and to make recommendations for the formal management plan. Turn to page 2 for his article.

* * * * *

• The reasons for hunting are very strongly held, and, in most cases, personal. But much of life today is geared toward the checkbook and cash register, so it's difficult to put hunting experiences in the field into dollars and cents terms. But, as **Rob Brooks** and **John Duffield** write, "Nonetheless, in a variety of public and private natural resource contexts, the question is increasingly asked: 'What Is Hunting Worth?' " As various groups compete more and more for use and development of natural resources—such as fish, wildlife, timber, minerals, and grasslands—it becomes imperative for land management agencies to know economic values for these resources. Then they can better determine which mix of resource use is in the best public interest. The Brooks/Duffield article is about bioeconomics—the economics of outdoor recreation. It's not easy stuff to grasp, but some of their conclusions will cause you to mutter under your breath, "Well, I always *thought* that, and now I *know* it for sure!" Brooks is a bioeconomist with the DFWP in Bozeman; Duffield is professor of economics at the University of Montana in Missoula. Part Two of this bioeconomics series begins on page 6; Part One, written by Duffield and titled "The Worth of Fishing," appeared in the Nov./Dec. 1988 *Montana Outdoors*.

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• The illustration for this issue's "Perspectives" on page 10 marks **Mike Mosolf's** debut in our pages. " 'Paneful' Tale of a Sage Hen" is an apt subject for his humorous touch because he claims to be national president of Sage Hens Unlimited. On the basis of this submission, we hope his presidential duties will leave time for work on other illustration for *MO*. In addition to his cartooning, he is also a fishing guide who lives in Dillon.

* * * * *

• The eagle is the "King of Birds," but **Dennis Flath** and **Al Harmata** believe the golden eagle may be the main reason for this acclaim. When you read their article, beginning on page 15, you'll understand why the golden eagle has so captured their attention—and ours. To start, take another look at the front cover photograph by Neal and Mary Jane Mishler—the golden-hued feathers on the head and nape of the neck are no doubt why it's called "golden" eagle. "Creatures of the wind," goldens are generally birds of open country. They soar or course hillsides, flapping their wings little, but using the wind to the fullest. Their use in falconry is legendary, and as Flath and Harmata write, "To watch a golden eagle soaring 1,500 feet above your head, waiting for its quarry, then diving on folded wings for the kill is a sight to behold and a thrill unsurpassed." Flath is the DFWP's nongame coordinator; information about Harmata is presented in Tom Palmer's accompanying sidebar, "Al Harmata: A Vision of Eagles."

* * * * *

• Efforts in Montana to protect wilderness are well known and oft-documented. But some efforts are also under way to protect "Vest-Pocket Preserves," which **Susan Reel** calls "biological marvels" and "geological jewels." These are natural areas selected for their scientific merit, not for their scenic or recreational value. They may harbor a rare plant or animal, or they could simply be a spot in which natural features are undisturbed. An example is the Sheep Bog Research Natural Area not far from Missoula. It contains deposits of volcanic ash, grains of pollen, spores, and other organic material which helps geologists trace the area's history. Reel is a biologist and free-lance writer and editor who lives in Missoula. She has worked as a contract writer for the U.S. Forest Service and also worked on the Montana Rivers Study (*Montana Outdoors*, May/June and July/August 1988). Her article begins on page 27.

* * * * *

• The bull trout is a "Travelin' Fish." It migrates from Flathead Lake to spawn in headwater tributaries of the Middle Fork of the Flathead within the Bob Marshall Wilderness or Glacier National Park. Migrating bulls from Flathead Lake also spawn in North Fork tributaries. And bull trout from Swan Lake spawn in upstream tributaries of the Swan River. It is also one of the largest fish native to Montana waters—it can reach three feet in length and weigh up to 25 pounds. **John Fraley** characterizes it as a "challenge" to anglers and notes that in the Flathead system, an angler may fish for 20 hours to catch just one. Fraley knows a great deal about bull trout—he's been involved in research on them in the Flathead system since 1980. He served on the Biological Resources Committee of the International Joint Commission which looked at potential effects of the proposed Cabin Creek Coal Mine in Canada on bull trout and other species. Fraley is fisheries program officer for the department in Kalispell; he thanks Tom Weaver, Mike Enk, and Laney Hanzel for their assistance with this article. It begins on page 32.

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• *MO* thanks the following photographers for their contributions to this issue: **Steve Arno**, Missoula; **David Genter** and **Steve Shelly**, Helena; and **Neal** and **Mary Jane Mishler** and **Rodney Schlecht**, Great Falls.

Vest-Pocket Preserves

STEVE SHELLY

DAVID GENTER

Sapphire rockcress (left) and Coeur D'Alene salamanders (right) are examples of rare plant and animal species that could benefit from natural area protection.

by Susan Reel

MONTANA, known for enduring efforts to preserve its vast wilderness, is also making a resolute effort to protect some parcels of land no larger than a few acres. These specks of land have been described as "biological marvels" and "geological jewels."

Take, for example, a little bog called the Sheep Mountain Bog Research Natural Area nestled in the coniferous forests of west central Montana, not far from Missoula. This 2.5-acre bog sits on a research natural area comprising 105 acres of U.S. Forest Service (USFS) land. It is one of the few protected mountain bogs in the Northern Rockies. Deposits of volcanic ash, grains of pollen, spores, and other bits of organic material within the bog help geologists trace the history of the vegetation. Relatively rare animals, like grizzly bears and northern bog lemmings, frequent this natural area.

Unlike wilderness areas, natural areas are selected by land managers for their scientific merit, not their scenic or recreational value. A disproportionate amount of wilderness is alpine country—"a lot of rock and ice," noted Joan Bird, Montana protection coordinator for The Nature Conservancy (TNC). TNC is an international conservation organization committed to preservation of biological diversity. Bird noted, "Wilderness areas are beautiful and they provide opportunities for solitude and recreation, but in terms of protecting all the various kinds of communities out there, they just don't do the job."

Natural areas are more comprehensive and diverse than wilderness areas, and need not be as large. "There will always be a necessity for small 'vest-pocket' kinds of preserves that only need to be large enough to protect rare, locally distributed, plants and animals," Bird said.

Sapphire rockcress (*Arabis fecunda*), a recently discovered plant species, could easily fit into a vest-pocket. This tiny cushion plant with delicate white flowers is one of the rarest plants known in Montana. It grows on a few calcareous (containing calcium carbonate) soil patches on rocky exposed slopes within the Sapphire Mountains that border the Bitterroot Valley of west central Montana and in the foothills of the Pioneer Mountains of southwestern Montana. Researchers have discovered six populations in Beaverhead County, four in Ravalli, and two in Silver Bow. Unfortunately, the Ravalli population's habitat has been invaded by an introduced weed, spotted knapweed.

Natural area programs focus on preserving biological and geological features throughout a state. "There are really two thrusts to a comprehensive natural area system," said Bird. "One is to have good representatives of everything that's common, and the second is to try to protect those things that are most threatened or rare."

It is difficult to find examples of undisturbed natural features in Montana. The Montana Natural Heritage Program in Helena—a cooperative project funded by the state and TNC—was

founded in 1985 to accomplish this task. Heritage program personnel are organizing a computerized inventory of the state's biological information. They have catalogued information on all 607 vertebrate species in Montana, 74 considered species of special concern because of their rarity or limited geographic distribution. The program also monitors approximately 350 plant species of special concern in Montana. "Eleven of them are found nowhere else in the world," stated Dave Genter, coordinator and zoologist for the program.

ALONG WITH RARE PLANTS and animals, examples of Montana's common natural communities are also protected by the various natural area efforts. For many years, natural resource scientists have struggled with a classification system for the diverse vegetation communities and habitat types in Montana. "It is very difficult to classify communities," said Bird. "They are just not as discrete as species are, and we have enough trouble with species, especially when we get into plants."

One example of a relatively common natural community in western Montana is the snow chutes in the Bitterroot Mountain Snow Avalanche Research Natural Area, 26 miles west of Hamilton. This proposed USFS research natural area encompasses 1,930 acres along the upper portion of Lost Horse Canyon. The spruce and subalpine fir-covered canyon slopes are extremely steep. In winter, as snow piles up, the heavy, wet mass triggers an avalanche. A loose-tumbling slide or slab of snow crashes down the canyon slopes, and trees growing within the snow chutes are toppled or ripped up. This constant battering by avalanches encourages growth of a unique group of low-growing shrubs such as alder, serviceberry, and Rocky Mountain maple. Avalanche chutes attract bears, mountain goats, elk, and songbirds and provide them with food, bedding, and nest sites.

Natural areas are becoming popular in other states because of their tremendous potential for recreation. "In most cases, public uses such as picnicking, hiking, and bird-watching are compatible with natural area protection," Bird said. There may be a few situations where a natural area is created to protect a very rare animal or a highly collectible plant such as an orchid. In such cases, Bird said, public use is discouraged.

Natural areas offer good opportunities for scientific research and education. They can be used as outdoor education centers for school children and adults. TNC encourages adoption of natural areas by local educational groups such as science classes, scout troops, or university environmental education classes. Programs such as adoption could increase awareness of the importance of natural areas as well. "There's a lot of information-gathering that could be done by people without a whole lot of technical expertise," Bird explained. The Sapphire rockcress site in the Sapphire Mountains may soon be protected as a natural area and would be an excellent site for this type of education program, she suggested.

WITHIN NATURAL AREAS, scientists gather baseline information useful in understanding natural systems and their processes. These undisturbed sites can be compared with ecologically similar sites that are being intensively managed for resource production. Wendel Hann, regional ecologist for the Northern Region of the USFS in Missoula, noted that within the proposed Big Creek Research Natural Area in the Kootenai National Forest, researchers are studying effects of prescribed fire to understand the re-establishment of plants.

Many different agencies and groups are involved in natural area protection. These include the USFS; U.S. Fish and Wildlife Service; National Park Service; Bureau of Land Management; Montana Department of State Lands; Montana Department of Fish, Wildlife and Parks; TNC, and the Montana Natural Heritage Program. The first four agencies (federal agencies) protect natural features through research natural areas, national parks, monuments, national wildlife refuges, wilderness areas, special interest areas, or areas of critical environmental concern. All federal land management agencies have research natural areas. Angela Evenden, botanist and natural area coordinator for the USFS Northern Region,

STEVE ARNO

Avalanche chutes in the Snow Avalanche Research Natural Area west of Hamilton provide an unusual mosaic of low-growing shrubs that attract bears, mountain goats, elk, and songbirds.

noted the USFS is establishing an extensive network of research natural areas throughout the country (like the Sheep Mountain Bog and Bitterroot Mountain Snow Avalanche Research Natural areas mentioned earlier).

Until 1974, only private or federally owned lands were protected as natural areas in Montana. The Montana Natural Areas Act of 1974 established a procedure for creation of natural areas on state land in Montana. This act initiated a legal framework for establishment of a system of "natural areas possessing significant scenic, educational, scientific, biological, and/or geological values...[to be] preserved for the benefit of this and future generations" (Section 81-2702, R.C.M. [Revised Codes of Montana], 1974.)

Unfortunately, despite good intentions, little progress has been made toward establishing a state program. One major setback was a 1976 attorney general's ruling that school trust lands could not be designated as natural areas without due compensation to the trust fund. According to a 1987 article in *Western Wildlands* by Bird and co-author D.J. Loop, because the program has never received state funding, the act has not been implemented.

Recently, a bill passed by the 1987 legislature revises the Natural Areas Act and makes preservation easier. As a result, the state can now act as coordinator. It can place natural areas in federal or private ownership onto the state register of natural areas. Unfortunately, the program still has not been funded. "It's important that the state keep track of everything that's been protected," Bird said. She emphasized that a state-coordinated natural area program could prevent duplication of natural area types and reduce the chance of leaving out significant communities or species.

Take, for instance, the Coeur d'Alene salamander, which is generating a lot of attention. It is from one to five inches long, with an ash-colored belly and a greenish-yellow stripe down its black back. Because of limited distribution, the U.S. Fish and Wildlife Service is considering it as a candidate for federal protection and it is protected by USFS regulations under sensitive species management. A recent heritage program survey shows that Montana has only 22 populations.

Historically, Montana's Coeur d'Alene salamander populations were isolated from other populations by glaciers. Such relict sites and the creatures that inhabit them are invaluable to researchers. In Montana and Idaho, in fact, the Coeur d'Alene salamander has been isolated so long that it is genetically distinct from a similar species in Washington. Coeur d'Alene salamanders lack lungs; instead, they breathe through their skin, which must stay moist. Therefore, they are restricted to "splash zones" along the water's edge of small tributaries and they cannot easily disperse to new areas.

Someday, the valuable relict areas that this unique salamander inhabits might become natural areas—and the future may be secure. ■

DESIGNATED* NATURAL AREAS IN MONTANA
(as of January 1989)

STATE LANDS

Department of State Lands:
Owen Sowerwine Natural Area, 442 acres, Flathead County

FEDERAL LANDS

U.S. Department of Agriculture, Forest Service:
Coram Research Natural Area (RNA), 839 acres, Flathead National Forest
Cliff Lake RNA, 2,291 acres, Beaverhead National Forest
Cottonwood Creek RNA, 128 acres, Beaverhead National Forest
Poker Jim Creek RNA, 363 acres, Custer National Forest
Petty Creek RNA, 310 acres, Lolo National Forest
Sheep Mountain Bog RNA, 105 acres, Lolo National Forest
Carlton Ridge RNA, 920 acres, Lolo National Forest
Pyramid Peak RNA, 520 acres, Lolo National Forest
Plant Creek RNA, 205 acres, Lolo National Forest
[proposed—Snow Avalanche Research Natural Area, 1,930 acres, Bitterroot National Forest]

U.S. Department of the Interior, Fish and Wildlife Service:
Sheep Mountain RNA, 85 acres, Red Rock Lakes National Wildlife Refuge
Two Calf Island RNA, 30 acres, Charles M. Russell National Wildlife Refuge (NWR)
Grand Island RNA, 160 acres, Charles M. Russell NWR
Prairie Dog Island RNA, 15 acres, Charles M. Russell NWR
Dillon Island RNA, 80 acres, Charles M. Russell NWR
Mullan Trail RNA, 392 acres, Benton Lake NWR
Big Island RNA, 251 acres, Medicine Lake NWR
Bruce's Island RNA, 367 acres, Medicine Lake NWR
Homestead RNA, 39 acres, Medicine Lake NWR
Tepee Hills RNA, 38 acres, Medicine Lake NWR

U.S. Department of the Interior, Bureau of Land Management:
Square Butte Outstanding Natural Area (ONA), 1,947 acres, Great Falls Resource Area/Lewistown District
Blind Horse Creek ONA, 4,927 acres, Great Falls Resource Area/Lewistown District
Ear Mountain ONA, 2,070 acres, Great Falls Resource Area/Lewistown District
Deep Creek/Battle Creek ONA, 3,086 acres, Great Falls Resource Area/Lewistown District
Chute Mountain ONA, 3,205 acres, Great Falls Resource Area/Lewistown District
Sleeping Giant Area of Critical Environmental Concern (ACEC), 12,048 acres, Headwaters Resource Area/Butte District
Rattler Gulch ACEC, 20 acres, Garnet Resource Area/Butte District

U.S. Department of the Interior, National Park Service:
12 RNAs, Glacier National Park (acres?)

PRIVATE LANDS

Pine Butte Swamp Preserve, 20,000 acres, The Nature Conservancy
Dancing Prairie, 560 acres, The Nature Conservancy
Crown Butte, 376 acres, The Nature Conservancy
Swan River Oxbow, 400 acres, The Nature Conservancy

TOTAL ACRES: 56,219 (0.06% of Montana's land)

* Designated, as per specific agency mandates. Owen Sowerwine Natural Area is the only site designated under the aegis of the Montana Natural Areas Act. Other areas may be managed as *de facto* natural areas, for example certain state parks and National Natural Landmarks.

Cruwys Scores A Double

by William G. Phippen

SCORING A DOUBLE ON DUCKS—or dropping two of the speedy birds from the same passing flight—is a notable achievement in any waterfowl hunter's book. Scoring a double by winning the Montana waterfowl stamp competition twice in three years is an equally impressive achievement for a wildlife artist.

But Roger Cruwys of Bozeman has done just that. His painting of a black Labrador retrieving a drake pintail has been selected for reproduction as Montana's 1989 waterfowl stamp. Cruwys' colorful "Evening Arrival—Redheads," graced the state's 1987 stamp.

Cruwys' painting of the retriever and pintail, the theme for this year's competition, was selected in October from among 32 other entries by a panel of six judges. Placing second, third, and fourth, respectively, were paintings submitted by Bob Kercher, Great Falls; A. Nadine Pickthorn, Nashua; and Connie Tveten, Wolf Point.

Cruwys, a self-taught painter who specializes in wildlife and outdoor subjects, is a full-time artist whose game birds, dog portraiture, and angling art have found ready acceptance throughout the country in major galleries, private collections, and national sporting magazines.

No stranger to state conservation stamp competitions, he has been a finalist in waterfowl or trout stamp competitions in California, Nevada, Ohio, South Carolina, Pennsylvania, Kentucky, Illinois, and Oregon, as well as Montana, and he has placed in the top 10% of the federal waterfowl stamp competitions he has entered. In 1984, the state of North Dakota commissioned Cruwys to paint its first-of-state trout/salmon stamp.

A native of upstate New York, Cruwys says his rural upbringing led him to develop an interest in nature and outdoor pursuits. Although he was a successful landscape architect/designer who received an undergraduate degree from Syracuse University and a master's from the University of California, he turned his attention toward the out-of-doors and wildlife art. Cruwys noted that dogs have always been one of his favorite outdoor subjects.

"It truly is an honor to have one of my works selected again" Cruwys said of this second win in the stamp

competition. "I'm also happy to be able again to personally contribute my talents for the benefit of the waterfowl stamp program."

IN EXPLAINING HIS WORK on the painting, he noted he wanted a finished product not distinctly Montana in character. "What I wanted was an appropriate setting, a misty morning that would appeal to a broader audience than just Montanans," he said. "After all, the name of the game is to create funds for the program."

Since 1986, hunters have been required to possess a state waterfowl stamp as well as the long-required federal "duck stamp" to hunt waterfowl in Montana. The 1985 Montana Legislature gave the Department of Fish, Wildlife and Parks authority to produce and sell a waterfowl hunting stamp and market related items. In 1987, more than 17,000 stamps were sold to Montana waterfowl hunters and several thousand collector's stamps were sold throughout the country.

Proceeds from sales of the waterfowl stamps and related artwork are used exclusively to develop and enhance Montana's wetlands for the long-term benefit of waterfowl on cooperating private, federal, and state-owned lands.

Funds for these wetland projects, as in previous years, will be garnered through sale of the 1989 waterfowl stamp ($5) and a series of limited edition prints that range from $140 for a signed print and stamp to $755 for the Executive Edition Print—a numbered and signed color remarque print with a stamp and 24k gold-plate medallion embossed with the Cruwys painting. The 1989 waterfowl stamp prints can be ordered through most art galleries in Montana.

Jeff Herbert, statewide waterfowl coordinator for the Department of Fish, Wildlife and Parks in Helena, said portions of the money raised to date have been spent on nesting platforms for geese, mallard net baskets, and wood duck nest boxes that have been placed in strategic locations throughout Montana. Private individuals and sportsman's clubs can participate in the program by contacting their nearest DFWP offices for more information.

One of the most important advantages of generating money for wetland enhancement projects through a state waterfowl stamp program is that it allows states, like Montana, to participate in Ducks Unlimited's MARSH program, Herbert said. MARSH—or **M**atching **A**id to **R**estore **S**tate's **H**abitat—provides state wildlife agencies with matching funds to be used to conserve local waterfowl habitat. Montana matches DU MARSH dollars with revenues generated from sale of the state waterfowl stamp and related items. Since it began in January 1985, DU has committed over $30,000 of MARSH funds to the DFWP for wetland improvement projects. A recently dedicated wetlands enhancement project at Canyon Ferry Wildlife Management Area north of Townsend is one of three Montana projects that have utilized these funds. A nesting island construction project on Big Lake near Billings and the department's artificial nesting structure program were recipients of the remainder of those funds. Three additional projects totaling $51,000 have recently received approval from DU under the MARSH program.■

Second Place—Bob Kercher, Great Falls

Third Place—A. Nadine Pickthorn, Nashua

Fourth Place—Connie Tveten, Wolf Point

TRAVELIN'

by John Fraley

THE RUBBER-SUITED BIOLOGIST pulled himself upstream, crawling like a turtle over the rocks in the shallow water. Through his mask he counted a few cutthroat trout, a whitefish, a bigger cutthroat. Then, as he entered a pool, he saw a tail fin as big as his hand poking out from under a log. Slowly pushing sideways through the water, the biologist quickly grasped just past the tail fin with his neoprene-covered fingers. He stood up in a stream small enough to jump across, with a wriggling fish over two feet long. The biologist's assistant carefully inserted a tag behind the dorsal fin and returned the fish to the stream.

The fish was a bull trout: olive-colored back, orange belly—a male about 28 inches long weighing seven or eight pounds. He had migrated 145 miles upstream from Flathead Lake to spawn in this headwater tributary of the Middle Fork of the Flathead River within the Bob Marshall Wilderness Area. Migrating bull trout from Flathead Lake also spawn in Middle Fork streams within Glacier National Park and in tributaries of the North Fork of the Flathead (up to 150 miles upstream into Canada). Bull trout in Swan Lake spawn in tributaries of the Swan River upstream from the lake.

These unusual "chars" (member of the trout family) scoop nests or "redds" up to the size of a pickup bed in the gravels of relatively small tributaries. They are considered a symbol of the Bob Marshall and Great Bear wildernesses, and are often used as indicators of the quality of water and fish habitat. Biologists have often cited protection of bull trout spawning and rearing habitat in streams as reason to modify timber sales and mineral exploration plans.

Biologists have studied bull trout intensively in the Flathead system and their biology is becoming better understood, but many questions remain unanswered about the status of the populations and their management. Biologists and managers concerned with this unique species have recently begun to debate these questions.

A Species of Special Concern

The bull trout is one of the largest fish native to Montana waters—it can reach three feet in length and weigh up to 25 pounds. Anglers value it as a challenge and a trophy and in the Flathead system, an angler may fish for 20 hours to catch just one.

Montana has recognized the uniqueness of the bull trout by classifying it as a "Species of Special Concern." It was so classified because the large form of the species (20 to 36 inches, four to 25 pounds) has limited distribution, and because smaller forms of the bull trout can hybridize with the eastern brook trout. Trophy-sized bull trout (fish weighing more than eight pounds) are found in relatively large numbers in only the Flathead Lake and River system (including Swan Lake) in northwestern Montana. Smaller numbers of

FISH

MIKE ADERHOLD

The bull trout, one of Montana's most highly prized trophy game fish, can reach three feet in length and weigh 25 pounds. This 21-pound, 12-ounce specimen, caught in Flathead Lake last year by Bob Staudenmayer, is the largest bull trout documented by the DFWP in more than 20 years.

large bull trout live in the Kootenai and Clark Fork systems.

Another reason the state is concerned about bull trout is their vulnerability to poaching and overharvest. These fish are easily snagged (illegally) in their spawning tributaries. People fishing legally in the river could also reduce the population because of the bull trout's readiness to attack spoons and plugs.

Bull trout are also threatened by degradation of tributary habitat. Forest practices and mineral development can increase sediments and water temperature in streams used by spawning adults and maturing young fish. Because most large bull trout use both lake habitat (to grow and mature) and stream habitat (for spawning and rearing of young), they depend on the health of the entire aquatic system for survival.

Patterns of Life

Most bull trout mature in lakes, where they reach trophy-size, then spawn in tributaries. This migratory lifestyle is referred to as "adfluvial." Some spend their entire lives in tributaries; when they are mature, they are about a foot long (these fish display a "resident" lifestyle). In the Clark Fork system, the fish grow two or three feet long in the rivers and then migrate into tributaries to spawn (this is referred to as the "fluvial" lifestyle). In Isabel Lake in Glacier National Park, "dwarf" bull trout mature at about a foot long.

Large, adfluvial bull trout grow to maturity in lakes (like Swan and Flathead), migrate upriver in the late spring, spawn in tributaries in the early fall, and return to the lake in the late fall. Young bull trout hatch in the early spring and live one to three years (reaching three to eight inches in length) in the tributaries before moving downstream through the river system to the lake (see Figure 1).

Adfluvial bull trout are particular in their choice of spawning areas, selecting low-gradient mountain streams with beds of clean gravel and areas of upwelling groundwater. Hiding cover such as logs and undercut banks is also important. These strict requirements make good spawning habitat limited and valuable.

Suitable habitat for rearing juvenile bull trout is also limited. Young bull trout require cold-water tributaries with good cover (rocks and woody debris) and relatively little streambed sediment. For example, most young bull trout are found in Flathead tributaries with average summer afternoon temperatures below a chilly 59°F.

Bull trout in the Flathead probably developed their migratory lifestyle in Glacial Lake Missoula, which drained near the end of the last ice age (about 10,000 years ago) leaving Flathead Lake as its remnant. This life strategy seems hard and inefficient, considering that mature fish are in the river system, away from the abundant forage fish of the lake, for nearly half of the year. That's probably why many adfluvial bull trout spawn every other year.

However, the adfluvial lifestyle may offer some advantages. These bull trout spawn in clean, well-oxygenated gravels of headwater tributaries, which greatly improves egg survival. When the young hatch, they aren't exposed to large predatory fish in the river and lake. While in the lakes, bull trout can take advantage of the abundant forage fish and suitable water temperatures for rapid growth. It could be that their use of a wide range of habitats has helped them survive.

Population Status

Biologists are using four methods to track the status or "health" of the bull trout population in the Flathead Lake and River system: (1) redd counts in the tributaries, (2) counts of juveniles in selected tributaries, (3) age and growth of fish in the lake, and (4) success rate of anglers fishing in the lake.

Since 1979, biologists have counted redds in four tributaries of the Middle Fork (Morrison, Lodgepole, Granite, and Ole creeks) and four tributaries of the North Fork (Whale, Trail, Coal, and Big creeks). Biologists believe the number of redds in the creeks reflects the number of spawning bull trout migrants from Flathead Lake (at a ratio of about three spawners per completed redd). The same creeks are surveyed each year, so the redd counts serve as an index of the spawning run from Flat-

head Lake.

Biologists have found that the number of bull trout in the spawning run from Flathead Lake (based on redd counts) has fluctuated from year to year (see Figure 2). More fish spawned in the index tributaries of both the North and Middle forks in 1982 than in any other year, but beyond that it's difficult to note any trend. In general, numbers of spawners in the the last few years are higher than in 1979-81, but lower than in 1982.

The second indicator of the status of the Flathead bull trout is the number of juveniles in tributaries of the North and Middle forks. To estimate the number of young bull trout in the tributaries, biologists introduce electric current into the stream through electrodes, and then net and count the stunned fish. The researchers make several passes through a stream section (usually 500 feet) and then derive an estimate for the entire section.

Biologists have used this technique to estimate the abundance of young bull trout in many tributaries of the North and Middle forks, but long-term information is available for only two streams: Coal Creek (North Fork) and Morrison Creek (Middle Fork). Because these are major bull trout spawning and rearing streams, biologists selected them as index sites for following the abundance of juvenile bull trout.

The number of young fish in the two creeks has varied from year to year (see Figure 3). Biologists have found from 85 to 179 young bull trout per 500 feet of Coal Creek and from 70 to 138 bull trout per 500 feet of Morrison Creek.

The third indicator of the status of the bull trout in Flathead Lake is the rate of growth of the individual fish. Bull trout in the lake grow about four inches per year, and can reach 34 inches or more by their ninth year. Studies conducted in 1980-81 found no major differences in growth rates or average size of mature bull trout in the lake as compared with investigations in the 1960s. Also, from the 1950s to the early 1980s, the size of fish in the river system spawning run has averaged about 25 inches.

These studies suggest as many large fish in recent years as there were 20 years ago, and that the growth rate for individual fish is about the same. Department of Fish, Wildlife and Parks biologists report that catches of bull trout in gill nets during the 1960s and early 1980s also show a similar size range. These factors point to a healthy population.

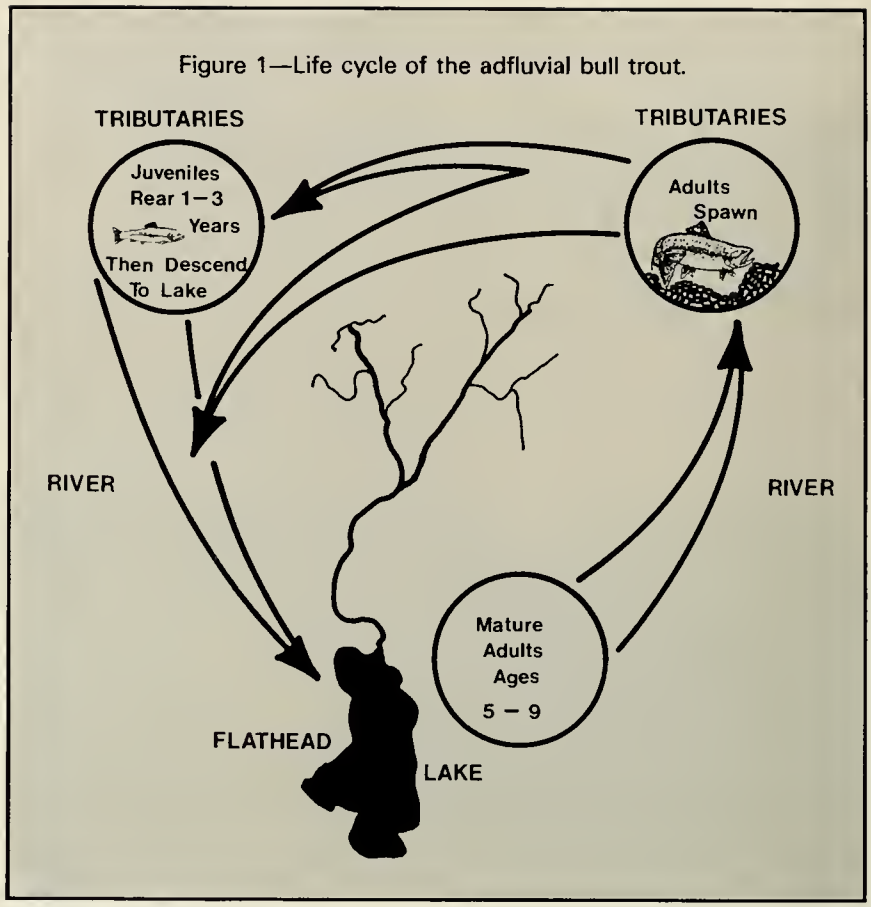


Figure 1—Life cycle of the adfluvial bull trout.

The fourth index of population status is bull trout angler catch rates. Stable catch rates usually indicate a stable population, although environmental conditions can change angler success from year to year. Biologists interviewed anglers on Flathead Lake in 1963, 1981, and 1985 as part of intensive creel surveys. Anglers caught bull trout at about the same rate in each of the three years (18 to 20 hours of angling required to catch a large fish). Surveys conducted on the Flathead River in 1975, 1981, and 1987 showed a similar catch rate for migrating spawners.

Threats to the Population

Large, adfluvial bull trout are sensitive to changes in their tributary and lake environs, and they can be susceptible to poaching and overharvest. These fish take from six to eight years to mature, and are never very numerous compared with many fish species. Because of these factors, bull trout can be easily harmed by man's activities.

Timber Harvest, Sedimentation

In the Flathead system, timber harvest has affected habitat in tributary streams used by spawning bull trout. When an area is logged, the access roads can cause increased sediments to be washed into the stream. The sediments can settle into the streambed gravels, reduce water and oxygen exchange for incubating trout eggs, and decrease egg survival. Decreased survival of eggs results in fewer young fish that rear in the tributary and later swim downstream to the lake.

To help assess the potential for log-

ging-related impacts, the Flathead National Forest has studied the sediment problem in tributaries of the North Fork of the Flathead River. To what extent does logging cause increased sediments in stream gravels? U.S. Forest Service Biologist Mike Enk is cautious about the study's results.

"There's strong indication that road development and logging have contributed to high levels of sediment in some streams, particularly in Coal Creek," says Enk. "The problem is that we don't have any information on the creek *before* logging took place—we're stuck with looking at data from only the last five or six years."

According to Enk, the Flathead Forest is concerned about how timber sales may affect stream habitat. "We're trying to find better ways of managing timber activities to cut down on the amount of sediment entering the stream from roads and cuts," he said.

Other efforts are being made to address the impacts of forest practices and sediment on streams. A study by the Environmental Quality Council and a cooperative Flathead Basin Commission study focus on "Best Management Practices," or measures required during logging activities to protect watersheds. Information from these studies should help to refine these protective measures and reduce the harmful effects of logging on water quality, fish, and fish habitat.

Cabin Creek Coal Mine

A major threat to bull trout in Flathead Lake is the proposed Cabin Creek coal mine along Cabin and Howell creeks (tributaries which support up to 10% of all spawning bull trout from Flathead Lake) in the North Fork drainage in Canada. Sage Creek Coal Ltd. has received Stage II approval for the mine—approval in principle of the mining plan, given certain studies are undertaken—from the British Columbia government. In April 1985, the matter was referred by the governments of Canada and the United States to the International Joint Commission (IJC) for environmental review because of concern over transboundary effects of development on the North Fork of the Flathead River and Flathead Lake.

The IJC established a joint Canada/U.S. Flathead River International Study Board and the board set up several technical committees (Mine Development, Water Quality and Quantity, Biological Resources, and Water Uses) to report on the potential environmental impacts of the mine on the North Fork drainage. The committees began work in July 1985 and completed their analyses by fall of 1987.

According to the reports prepared by the Mine Development Committee and the Water Quality and Quantity Committee, the mine would severely degrade the aquatic habitat of Howell Creek. The water temperature of the creek would be raised and increased sediments would settle into the streambed because of the removal of forest canopy and road building during the preliminary phase of mine construction. Dissolved nitrogen (from explosives) would increase in the groundwater feeding the stream. The channel of Howell Creek could be modified and damaged.

These environmental changes would mean the end of significant bull trout spawning and rearing in Cabin and Howell creeks, according to the Biological Resources Committee.

"The construction of the mine would eliminate the habitat which supports bull trout spawning and rearing in Howell and Cabin creeks," says Alan Martin of the British Columbia Ministry of the Environment and Canadian co-chair of the Biological Resources Committee. "The mine might not kill the fish directly, but the destruction of fish habitat would quickly reduce the population to low or nonexistent levels."

U.S. co-chair of the Biological Resources Committee, Loren Bahls of the Montana Department of Health and Environmental Sciences Water Quality Bureau, echoes Martin's sentiments.

Figure 2—Number of bull trout "redds" or nests in selected North Fork tributaries, Middle Fork tributaries, and both forks combined, 1979-88.

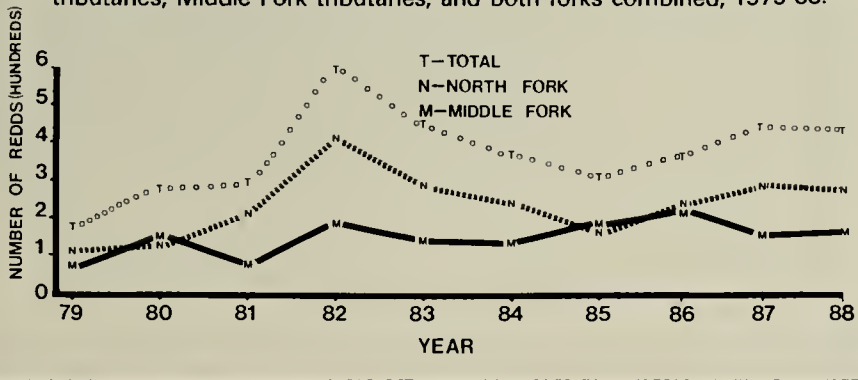
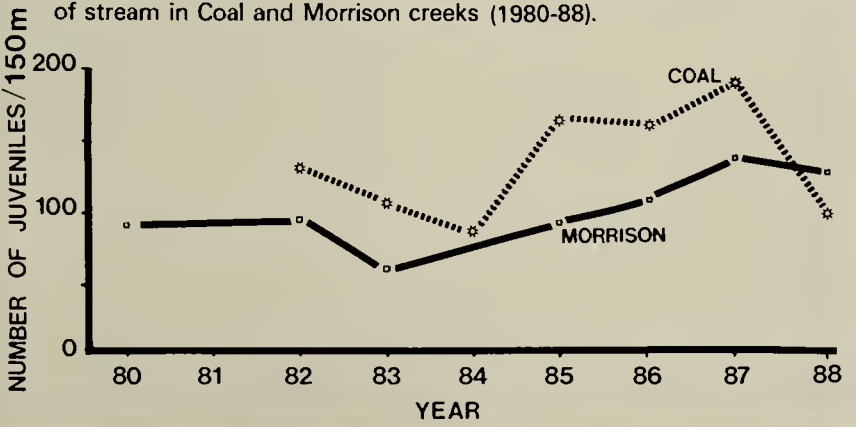


Figure 3—Number of young bull trout per 150 meters (about 500 linear feet) of stream in Coal and Morrison creeks (1980-88).



"Even if mature bull trout moved into Howell Creek after the mine was built, they probably couldn't spawn successfully," says Bahls. "Their eggs would be destroyed by high sediment and nitrogen levels in the gravels."

Neither Martin nor Bahls sees any prospect for recovery of bull trout in Howell Creek if the mine were built. They cite the unique nature of the habitat in the mine site area that would be lost, probably forever. Adds Bahls: "There's just nowhere else for the fish to go."

If the Howell Creek segment of the bull trout population is lost, it could result in a 10% reduction in the bull trout population of Flathead Lake. Besides being a serious blow to the Flathead Lake population, this loss would hurt the economy of the Flathead Valley. The Water Uses Committee calculated a total value of $4.97 million annually (1986 U.S. dollars) for the bull trout fishery in the Flathead Lake and River system in Montana. The loss of Howell and Cabin creeks as producers of bull trout would mean a loss of hundreds of thousands of dollars annually to the area's economy.

The board considered findings of the technical committees and submitted an overall report to the IJC for deliberation. In September, hearings were conducted on the proposed mine in Kalispell and in Cranbrook, British Columbia; public sentiment at both meetings indicated overwhelming opposition to the mine as planned. Negotiations between the U.S. and Canadian governments continue.

Overharvest

Because of the restricted distribution of bull trout spawning in the Flathead Basin and the limited size of the known annual spawning run, harvest of mature fish by anglers in both the lake and river can have a dramatic impact on the population. Biologists estimate that only 3,000 to 5,000 bull trout from Flathead Lake escape harvest and successfully spawn in tributaries. Any increase in fishing pressure and harvest could reduce the spawning population, causing a loss of juvenile production, and reducing the population in Flathead Lake.

The segment of the population most vulnerable to overharvest is the upper river stocks. These fish can be seen in the clear headwater streams, and must run the angling "gauntlet" through the entire river system to reach spawning areas. Mostly because of this vulnerability, DFWP lowered the creel limit in the lake and river from two to one fish in 1982. The B.C. Ministry of the Environment reduced the creel limit to one fish in the Canadian portion of the North Fork in 1983.

Bull trout are mostly protected from angling once they reach the tributaries in which they spawn. The DFWP closed most of the important spawning streams to angling in the early 1960s, and Glacier Park did likewise on important streams within park boundaries in the 1970s. In 1983, the B.C. Ministry of the Environment closed to angling all North Fork tributaries in Canada used by spawning bull trout.

Hybridization with Brook Trout

Bull trout, especially those in the Clark Fork system, are jeopardized by hybridization with the non-native eastern brook trout. The two species interbreed readily, and most of the hybrids are sterile. According to DFWP records, brook trout live in over one-third of Montana's bull trout streams. Where ranges overlap, brook trout may be able to outcompete bull trout.

Hybridization is probably a serious problem only to the smaller, tributary-resident bull trout. The University of Montana Genetics Laboratory identified bull trout/brook trout crosses in Lolo Creek, a tributary of the Bitterroot River, south of Missoula.

Future Management of Bull Trout

The keys to managing large, adfluvial bull trout in Montana are two: (1) protection of their tributary spawning and rearing habitat, and (2) control of harvest by anglers.

To a large degree, the quality of spawning and rearing habitat controls the bull trout populations in Flathead Lake and Libby Reservoir. Biologists believe that timber harvest and other human activities already have damaged some streams used by spawning bull trout. The challenge will be to prevent further harm to the delicate habitat in these tributaries.

DFWP Region 1 Fisheries Manager Jim Vashro emphasizes the importance of continued work with the U.S. Forest Service on forest plans and timber sales. Says Vashro: "One thing we'd like to see more of in the forest plans is an emphasis on long-term monitoring of the effects of timber harvest on aquatic habitat."

Vashro cites the difficulty of balancing timber harvest with a quality environment. "It seems that the best we can do is a compromise," he says. "To protect one portion of a stream, we sometimes have to sacrifice another portion."

There have been successes in the battle of habitat protection in the Flathead system. For example, in 1985, a timber sale in the Akinkoka drainage of the North Fork was halted and is being modified because of the potential damage to bull trout spawning and rearing habitat in Akinkoka Creek and downstream in Whale Creek.

Future management of bull trout must also focus on control of the harvest of mature fish by anglers. Vashro notes that the bull trout has been managed as an individual species in the Flathead system for over 20 years. The species is protected by reduced creel limits and tributary closures.

"We feel we can maintain the current level of harvest in both the river and the lake as long as our abundance indicators remain stable," says Vashro. He adds that a creel census was conducted for the North Fork of the Flathead River during the spring and summer of 1987. This was the first census of the river harvest since 1981, and it yielded a direct measure of angler impact on migrating fish.

Preliminary results from the 1987 census indicated a harvest of approximately 200 bull trout, as compared with a harvest of 400 estimated during the last census conducted on the North Fork in 1981. This apparent reduction in harvest could be related to the change from a two-fish to a one-fish angling

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Classified as a "Species of Special Concern," the bull trout is being closely monitored by DFWP biologists in the Flathead Basin. One indicator of its status is the number of juveniles in tributaries of the North and Middle forks. Biologists are able to derive population estimates by netting and counting the young fish stunned through electrofishing in a stream section.

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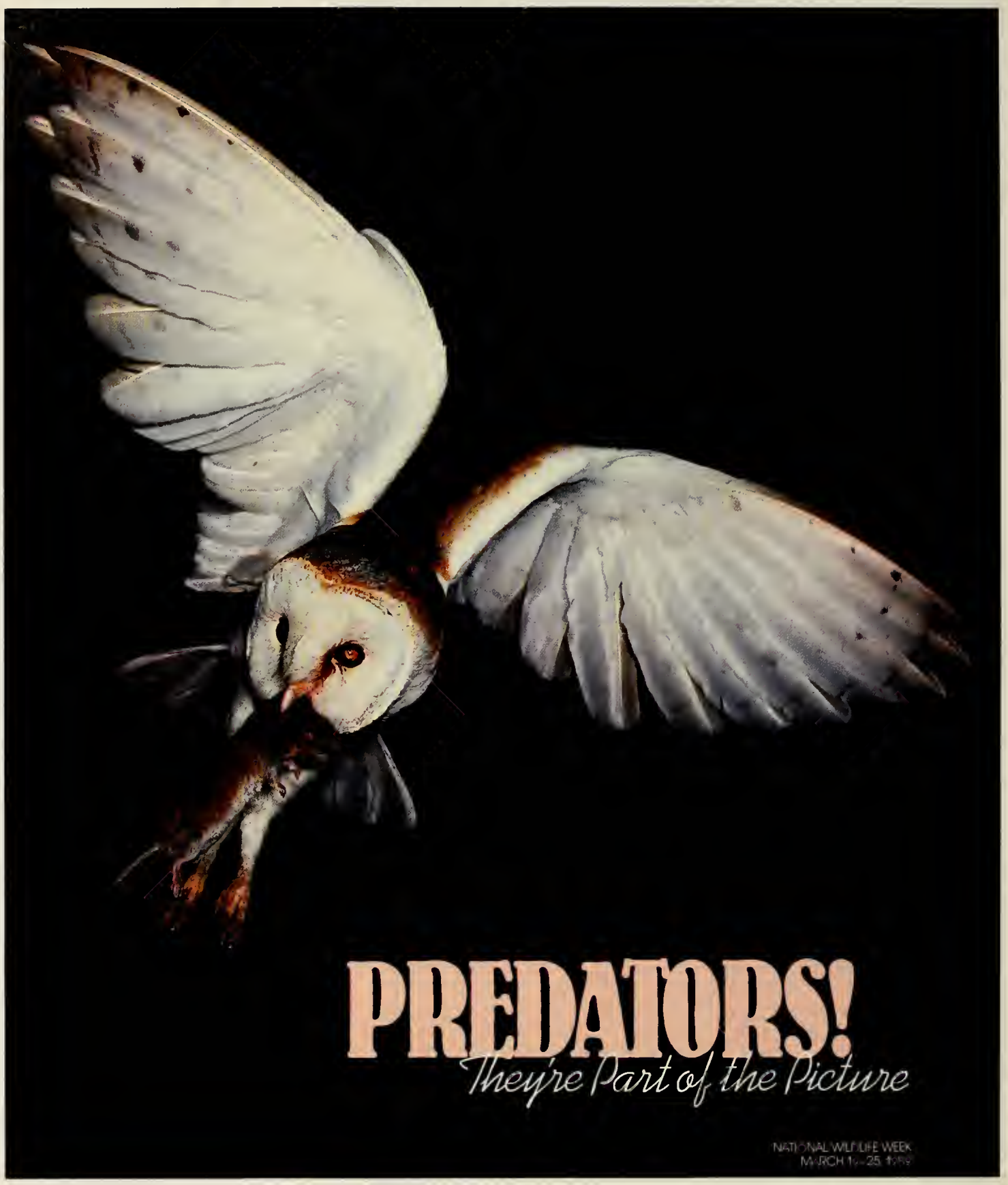
limit in 1982, or to an increase in catch and release fishing.

"We don't want to cut the angling public out of the picture," says Vashro, noting that the bull trout is the only trophy-sized fish available to anglers in the Flathead River system. "To a large extent, the anglers support our management and protection efforts for the species," he added.

Even though the abundance indicators for bull trout in the Flathead Lake and River system have remained relatively stable, the Confederated Salish and Kootenai tribes, co-managers with the DFWP of the Flathead Lake fishery, advise caution in managing harvest of the spawners by anglers. The Tribes are worried that anglers may be taking too many migrating bull trout in the river system. In 1985, Tribal biologists tagged 17 adult bull trout in Flathead Lake. Subsequently, eight of these fish were caught on their spawning run in the Flathead River. Although these findings are based on a small sample of tagged fish, they raise a red flag on the potential for overharvest in the river system.

The DFWP is also working closely with the B.C. Ministry of the Environment on controlling harvest of migrating spawners. Says Alan Martin of that agency: "The fish is already heavily protected, and I don't think it's time to push the panic button yet. But if we see further declines in the spawning run in the Canadian portion of the North Fork, we will have to look at closing the river to angling." Martin adds that, based on a limited survey, harvest was light on the North Fork during the summer of 1987.

So the trophy bull trout has been studied and protected. It's becoming obvious, though, that yet more study and protection is needed to sustain the present population level of adfluvial bull trout in Montana. As many ecologists and naturalists, including Muir and Thoreau, have noted, quality habitat is the major requirement for healthy populations of animals. If managers can win the battle of habitat protection in important tributaries, they will be much of the way toward protecting the bull trout. ■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